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Original qualitative research

Barriers and facilitators to improving health care for adults with intellectual and developmental disabilities: what do staff tell us?

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Abstract

Introduction: Adults with intellectual and developmental disabilities (IDD) have high rates of morbidity and are less likely to receive preventive care. Emergency departments and primary care clinics are important entry points into the health care system. Improving care in these settings can lead to increased prevention activities, early disease identification, and ongoing management. We studied barriers and facilitators to improving the care of patients with IDD in three primary and three emergency care sites in Ontario.

Methods: Data sources included structured implementation logs at each site, focus groups (n = 5) and interviews (n = 8). Barriers and facilitators were coded deductively based on the Consolidated Framework for Implementation Research (CFIR). Synthesis to higher level themes was achieved through review and discussion by the research team. Focus was given to differences between higher and lower implementing sites.

Results: All sites were challenged to prioritize care improvement for a small, complex population and varied levels of implementation were achieved. Having national guidelines, using local data to demonstrate need and sharing evidence on value were important engagement strategies. Factors present at higher implementing sites included strong champions, alignment with site mandate, and use of electronic prompts/reminders. Lower implementing sites showed more passive endorsement of the innovation and had lower capacity to implement.

Conclusion: Providing effective care for small, complex groups, such as adults with IDD, is critical to improving long-term health outcomes but is challenging to achieve. At a systemic level, funding incentives, access to expertise and improved electronic record systems may enhance capacity.

Keywords: intellectual disability, developmental disabilities, implementation, primary health care, emergency medical services, quality improvement, barriers and facilitators

Highlights

- We worked with three emergency departments and three primary care clinics across Ontario to implement evidence-based practices for high quality care of adults with intellectual and developmental disabilities.
- While some sites made considerable progress, others were challenged to make sustainable improvements.
- More successful implementation occurred when sites had strong champions, an interest in this patient group and used electronic prompts and automated point of care tools to embed new practices.
- Less successful sites were challenged by staff turnover, low morale and passive endorsement from leadership.
- Given these challenges, system level supports are important for wider spread of this intervention.

Introduction

Adults with intellectual and developmental disabilities (IDD) are an extremely vulnerable population with complex health needs. Compared to those without IDD, they are more likely to develop a range of chronic conditions including diabetes, congestive heart failure, chronic obstructive pulmonary disease, seizure disorders, gastrointestinal disorders and psychiatric disorders, and they are less likely to receive preventive care.[1-4]

To improve health outcomes for adults with IDD, two important targets for improved practice are the emergency department (ED) and primary care (PC) settings. Both serve as main entry points into the health care system, playing a critical role in providing early and accurate diagnosis, early intervention, and linking individuals to needed community supports. Prior research has shown that although adults with IDD have similar rates of PC

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use and higher rates of ED visits than the general population,[1] care provided in these settings can be insufficient, or inappropriate.[5-7]

The ED and PC are both generalist settings, in that they provide care to a wide variety of patients, and people with IDD are not their exclusive focus. Adults with IDD are more likely to have complex health profiles[3] and may additionally have difficulty communicating their health concerns.[8] Staff in these general health care settings often lack sufficient training in the specific health complexities of adults with IDD, and may lack the time and training to appropriately adapt communication and care processes.[9-13] Staff may also have difficulty recognizing which patients have IDD, making adapted or accommodated care impossible.[13,14] Finally, stigma and misconceptions regarding individuals with IDD still exist in wider society and health care professionals are not exempt.[15-17] Improving the quality of care in these settings can contribute to reduced hospital use, and improved long-term health outcomes.

An evidence base of strategies to improve quality of care for patients with IDD in these two settings is emerging,[9,18,19] yet, relatively little research has examined how to implement these strategies in practice. Practice change can be challenging[20] and interventions successful in research settings often fail to be implemented in practice.[21,22] Systematic efforts to improve care for adults with IDD face the additional challenge that they represent only about 1% of the population[23] and thus may be viewed as having lower priority than other more frequently seen patient groups. A few studies in the UK and Australia have looked at barriers to PC improvement,[9] however, they were limited to physician feedback and, due to differences in health care systems, may not translate to the Canadian context. We only identified one previous study on barriers to implementation in the ED, conducted in the UK.[24] None of these studies reported a structured, staged approach to implementation, which was used in our study and has been shown to improve implementation success.[22]

In our present study, we supported three hospital EDs and three PC clinics located across Ontario, Canada in a structured practice change process to improve care of adults with IDD. In each setting the improvement work addressed three common core components: (1) identification of patients with IDD; (2) provision of modified care (e.g. adapted communication, improved discharge planning, community linkages); and (3) staff training and support. The core components were identified based on input from patients, families, and clinicians, the literature and established guidelines, where available. The PC intervention (the periodic comprehensive health exam) was recommended in Canadian national clinical guidelines on the primary care of adults with IDD[18] whereas the ED intervention included evidence-based strategies, but these were not recommended in equivalent guidelines or standards. These common core components were adapted to fit within the specific context of each setting based on feedback from patients, families and clinicians; more detailed descriptions of intervention selection and development have been published elsewhere.[6,25,26,27]

This paper reports staff perspectives on the extent of implementation achieved and barriers and facilitators encountered across the six study sites. Study findings can contribute knowledge about strategies to improve the quality of care for adults with IDD in these key settings and complement prior work from the service user perspective.[26-31]

Methods

Implementation

A structured, staged implementation process was used at the six study sites following the four stages of the National Implementation Research Network (NIRN) model:[22]

- *Exploration:* Generate staff awareness and engagement.
- *Installation:* Plan and implement required changes, tailored to the setting.
- *Initial implementation:* Begin intervention delivery, collect feedback to refine and improve the process.
- *Full implementation:* Fully incorporate intervention into ongoing routine practice.

Exploration was initiated in the first two sites (*ED 1* and *PC 1*) in spring 2012, and in four additional sites in spring 2013. The study was completed in March 2015 and follow up data was collected from March to July 2015.

Implementation was supported through a partnership between the central research team and the local site implementation team, which minimally included a local lead (a senior physician or administrator), and a paid implementation facilitator. At some sites the local lead recruited additional staff (e.g. physicians, nurses, social workers, administrative staff) to participate on the implementation team. The central team provided content expertise, and together with appropriate experts depending on the tool (clinicians, patients, and families) helped to develop and adapt tools for each setting and provided overall project management support. The local site implementation team was responsible for the internal implementation of the practice change, including the logistics of incorporating new processes and resources, and engaging and training site staff.

Data sources

See Table 1 for an overview of data collection by site.

Implementation log

A structured template was used to record each site's progress through the implementation stages including: status, activities conducted to achieve progress and any helping or hindering factors. Each log was updated periodically during the study, minimally at the study mid-point and at study completion, by a central evaluator based on interviews with the site facilitator and other staff as needed. One site (*PC3*) left the study early and, therefore, only had one point of completion. The same evaluator conducted all interviews to maximize consistency and reliability. Multiple points of completion were critical to capture the evolving experience over time and to ensure no loss of data due to memory distortion or staff turnover.

Staff focus groups/ interviews

At study completion, focus groups, or individual interviews when focus group participation was not possible, were conducted with the site implementation teams using a semi-structured guide. Based on the implementation literature[21,32-34] the guide addressed: barriers and facilitators to implementation, value of the facilitated implementation process, and strategies to support sustainability.

TABLE 1
Data collection by site

Site	Focus groups, n	Interviews, n	Implementation logs, n
PC1	1 (7 participants)	1	2
PC2	1 (2 participants)	0	2
PC3	0	5	1
ED1	1 (10 participants)	1	2
ED2	1 (5 participants)	0	3
ED3	1 (3 participants)	1	3

Abbreviations: ED, emergency department; PC, primary care.

As indicated in Table 1, across the six sites, eight individual staff interviews and five focus groups with a total of 27 staff were conducted. Participation varied by site due to the range in size and composition of the site implementation teams. Focus group discussions lasted approximately one hour; individual interviews were generally 15-30 minutes. All were digitally recorded and transcribed.

While the research team supported both the implementation and the evaluation, the functions were separated and the evaluators on the team did not deliver implementation support.

Analysis

The stage of implementation achieved was determined based on the implementation logs and focus group feedback; final ratings were verified by the implementation leads.

Barriers and facilitators were identified though deductive analyses of all study data sources based on the Consolidated Framework for Implementation Research (CFIR),[23] while remaining open to newly emerging themes. CFIR was developed based on a synthesis of pre-existing implementation theories and offered an overarching typology of factors that influence implementation success from which researchers could select the constructs most relevant to their own research. Using CFIR allows for cross study comparisons and can help advance understanding of the critical components of successful implementation.[35]

CFIR constructs are organized into five major domains. Four were applied to this study: characteristics of the intervention (e.g. evidence strength, complexity of target population); the outer setting (e.g. system policy, resources); inner setting (e.g. organizational culture, leadership, intervention compatibility with program mandate); and the implementation process (e.g. engagement of key stakeholders, implementation team). The fifth domain, characteristics of individuals involved (e.g. knowledge and attitudes), was not included as the study focused on organizational factors and data on individual staff characteristics were not collected.

All text was reviewed and coded according to CFIR. First level synthesis was conducted across data sources at site level. Themes were then synthesized across sites through review and discussion by three team members, focusing on differences between higher and lower implementing sites. Final results were reviewed by the site implementation leads for validation and accuracy. Quotations from focus groups and interviews are included to illustrate findings.

Research ethics board approval for the study was received from the home institution of the research team and the academic institutions of the participating sites.

Results

Stage of implementation achieved

The extent of implementation achieved at each site varied across the four NIRN stages (see Figure 1). Of the six sites: one reached full implementation (*PC 1*); four achieved some degree of implementation but were unable to fully incorporate the intervention into routine practice during the study period (*ED 1, ED 2, ED 3, PC 2*); one did not proceed past the exploration stage (*PC 3*).

Barriers and facilitators to implementation

Barriers and facilitators to implementation were organized according to CFIR. See Table 2 for an overview of themes identified.

Intervention/population characteristics

A consistently noted barrier across sites was that adults with IDD represent only a very small portion of patients. They, furthermore, comprise a high need, time consuming and heterogeneous population that staff are often uncomfortable or unfamiliar with treating.

> This is a complicated area of implementation. You have a high needs group that you don't see every day. In a sense... and I have some experience with implementation, that's why I'm so impressed with what we've achieved... that usually means zero uptake. That combination of – complicated but you have to remember the complexity and you don't see them very often – that's usually a full stop. (Site lead, ED 1)

This barrier was offset to some extent in the PC settings by the intervention's grounding in national clinical guidelines, which informants felt provided legitimacy and some external pressure to implement. By contrast, there were no established guidelines to draw on for the ED intervention.

Outer setting

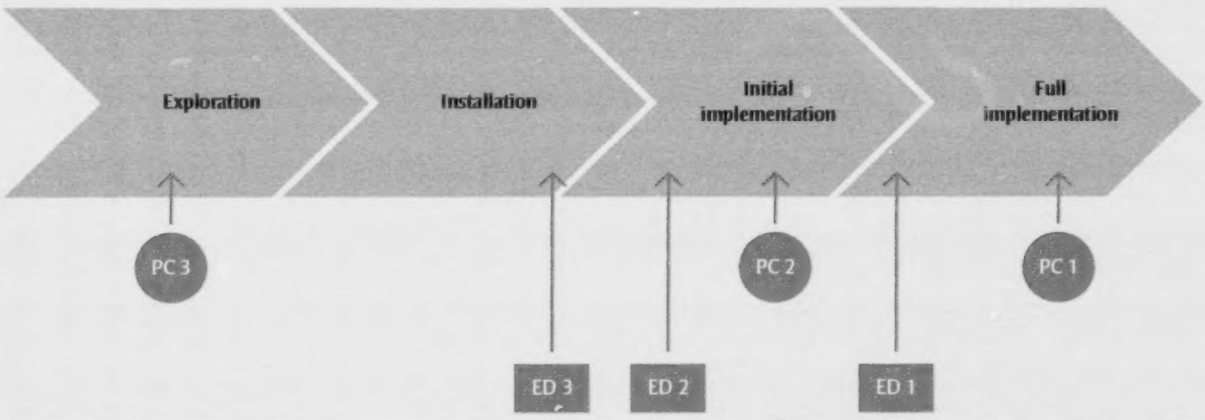
Less focus was given to the outer setting by informants. However, one issue raised in the PC sites, particularly the lowest implementing site (*PC 3*), was the absence of any financial incentives for this work. This is a complex, time-consuming population to care for and some felt that financial incentives for physicians would support implementation.

> I'd like to say no. I don't think any of us are rooting for money. However, on the other side when there are incentive payments for doing things, we do them more. Incentive payments I think would sadly make sure we follow up, make sure everybody gets seen. (Physician, PC 3)

Inner setting

Much of the feedback focused on issues related to the inner setting. Across all six sites a recurring challenge was lack of resources; staff were extremely busy, with a multitude of other projects competing for attention.

FIGURE 1
Stage of implementation achieved by site



Abbreviations: ED, emergency department; PC, primary care.

> It's the same that we face with all practice change where it's competition for oxygen and bandwidth. There's always a long list of potential quality improvement projects or other priorities. So, you're always competing for people at the same time that we're trying to reduce waiting times, and improve hand washing, and whatever the focus of the organization is. (Clerk, ED 1)

> I think this piece gets buried under so many other problems. Sometimes, really, the DD thing isn't on top of the list because there's just so many other things there. (Site lead, PC 2)

Despite this common starting point, however, the presence of facilitators including alignment with site mandate, research or quality improvement experience, good timing, high perceived number of patients with IDD, strong leadership and available resources, allowed some sites to prioritize this work. These facilitators are described in more detail below.

All the higher performing sites emphasized the value of intervention alignment with their organizational cultures and mandates—i.e., collaboration (*PC 1*), improvement and innovation (*ED 1, PC 2*), patient centered care (*ED 2*) and marginalized

TABLE 2
Domains and themes identified

Domain	Themes (relevant CFIR construct)
Intervention characteristics *Factors related to site perception of the intervention (and target population)*	• Low prevalence population (relative advantage) • High need, heterogeneous population (complexity) • Evidence base of the intervention (evidence strength and quality)
Outer setting *Factors related to system external to the study site*	• Financial incentives or accountabilities to deliver the intervention (external policy and incentives)
Inner setting *Factors internal to the study site*	• Competing initiatives and demands on site resources (relative priority) • Alignment of the intervention with organizational culture and mandate (compatibility) • Experience with research and quality improvement (readiness for implementation) • Implementation timing (readiness for implementation) • Perceived number of site patients with IDD (relative priority) • Clinical champions and senior administrative leadership (leadership engagement) • Available staff resources (available resources)
Process *Factors related to the process of implementing the intervention*	• Staff engagement (engagement) • Skills and composition of implementation team (formally appointed internal implementation leaders) • Role of research team (external change agents) • Use of EMR for sustainability (executing) • Proactive identification (executing) • Time available to implement (executing)

Abbreviations: CFIR, Consolidated Framework for Implementation Research; EMR, electronic medical records; IDD, intellectual and developmental disabilities.

populations (*PC 2*). Some sites also highlighted their experience with research and quality improvement as beneficial (*PC 1, PC 2, ED 1, ED 2*) and it helped that there was a small amount of funding attached to the project (*ED 2*).

> Part of the reason we engaged in this was because of the supports, the frame, and then how it fits within what we envisioned was important. (Director, ED 2)

> We like [projects] that allow us to take a quality improvement approach that can be collaborative, that can be interdisciplinary and so this aligned with all of those objectives, so it fit in nicely. (Clinical Program Coordinator, PC 1)

In contrast, the lower performing sites reported issues related to low staff morale, burnout and change fatigue (*ED 3*), or having a less collaborative, more business focused environment (*PC 3*). They emphasized that although providing high-quality care to adults with IDD was important, it was simply not their top priority, or it was something they felt they already provided (*ED 3, PC 3*).

> I mean I think we recognize that these people need appropriate care and want to provide that but...I guess people haven't really seen it as perhaps a bigger problem as some other things. (Physician, PC 3)

Several sites were also challenged by poor timing, with major structural changes or serious clinical interruptions that had to take precedence; for example: organizational restructuring (*PC 2, ED 3*), new electronic medical record (EMR) platform (*ED 3, PC 3*), moving physical locations (*PC 3*), community health crisis requiring ED response (*ED 2*).

> Nurse managers changing over... clerical managers disappearing... people who were very good system implementers moving on to other positions. In that vacuum it is very hard to get traction on getting something going. (Site lead, PC 2)

Another important factor was whether there was a pre-existing focus on this population. *PC 1* reported having a relatively high number of patients with IDD in comparison to other PC practices which facilitated buy-in.

> We have a fairly large population of adults with IDD so ... there's a lot of people who were interested in the topic and again, it was a nice project for us. (Clinical care coordinator, PC 1)

Other sites initially felt they had very few patients with IDD and did not see the project's relevance. For some, this perception was overcome through staff education, local data demonstrating high service use by adults with IDD, or, at one site, a sentinel event involving a patient with IDD. However, for others the perception prevailed.

A clear difference between the higher and lower performing sites was leadership. The higher performing sites (PC 1, PC 2, ED 1, ED 2) had strong clinical champions and support from senior leadership. Often champions who stepped forward had personal connections or significant clinical experiences with individuals with IDD.

> I think the people that were on the team are leaders and were respected and credible champions [...] I think the people that were brought in on this have a level of credibility and trust amongst their peers [...] and that's an important piece. (Implementation facilitator, ED 1)

At the lower performing sites (*ED 3, PC 3*), senior leadership only passively endorsed the project.

> There was no support from administration, really it ...just felt very... demoralizing. (Allied health worker, PC 3)

All sites faced competing demands on staff time; some, however, made the decision to prioritize and focus capacity on this project. There were also differences in the baseline resources available at each site. For example, *ED 1* had full time social work coverage while *ED 2* and *ED 3* had very limited social work coverage. By necessity this led to differences, sometimes limitations, in how the intervention was implemented and the level of interprofessional involvement.

Process

An important part of the implementation process was staff engagement; however, this was challenging. It proved difficult for the implementation teams to set up meetings with site staff due to high clinical demands, even standing meetings were often cancelled (*ED 1, PC 2, PC 3*), and site leads lacked sufficient time for ongoing staff communication (*PC 2*). Some sites, however, offered examples of creative strategies to engage staff including continuous communication and 'advertising' the intervention, use of colourful posters, screen savers and email blasts.

> I think just keeping it on the radar, it just can't be a one-shot blitz of here's [the intervention], here's posters, here's this, here's that and then it just – that's it. I think it has to be revitalized on a regular basis. (Clinical educator, ED 1)

An important strategy at *ED 2* was including frontline clinicians in designing the intervention, providing a sense of ownership. *PC 1* emphasized the value of allowing participating staff to volunteer, rather than being assigned, to ensure the intervention is delivered by passionate and dedicated individuals.

> ...it wasn't that it was dumped on someone, it was somebody who was actually interested in the topic. (Clinical program coordinator, PC 1)

Also important was engaging with stakeholders who were external to the setting. This was particularly true for the EDs who had to work closely with the community sector to implement communication tools. While one of the higher implementing sites (*ED 2*) reported developing an excellent relationship with the community, a lower implementing site (*ED 3*) described considerable barriers due to tensions between hospital and community perspectives.

> I remember at the beginning of the project looking towards [community representatives] saying, 'You are the experts. We are the experts in acute care, you are the expert in this area. Assume we know nothing. Teach us what we need to know.' And I think that contributed to just valuing the expertise of others and not... we needed the expertise. I think that is the key point. (Director, ED 2)

> I think that the agencies have really good relationships with the emergency department here... but the language of social services and the language of health are so different, and so sometimes that is difficult. (Community facilitator, ED 3)

A strong inter-professional implementation team was also identified as an important facilitator (*PC 1, ED 1, ED 2*). Missing representation from any professional group inevitably resulted in challenges implementing aspects of the intervention relevant to that group. It was also important that team members worked well together, were passionate about the project, and had the right skillset for the job.

> Well, just one of the learnings is that it takes a team. It's definitely not a one or two-person thing. It's having facilitators and having [the manager] and [the nurse educator], and a physician contact [...] It really was a team approach. (Implementation facilitator, ED 2)

Challenges arose in the lower implementing sites where team members lacked the necessary skills and interest in the project or did not have the authority or receive the necessary support to move the project forward (*ED 3, PC 3*).

> I think the lack of enthusiasm and support [was the biggest barrier]... because it just felt like dragging your feet through the mud... so with all the other stuff going on it was really easy for it to get lost, you know? It was just really, really easy for it to go 'oh well nobody cares, what's the point.' (Allied health worker, PC 3)

The lower implementing sites (*ED 3, PC 3*) were also challenged by the turnover of key members of the implementation team mid-way through the project. These gaps in staffing considerably challenged implementation efforts.

Most sites emphasized that support from the central team, including tool development, content expertise and project management support, was critical to the success of the project and felt it was unlikely they would have proceeded with the project in the absence of the central team.

Because this population is seen infrequently, sites found one-time training to be insufficient. The higher implementing sites (ED 1, PC 1, PC 2) embedded automated prompts, flags, tools and reminders into their EMRs. Sites without flexible EMRs or who could not, or did not, work to modify their EMRs, faced greater challenges achieving sustainability (*PC 3, ED 2, ED 3*).

In some respects, the PC settings had an advantage because they are familiar with their patient population and can proactively identify and flag patients with IDD in their roster. In contrast, ED visits are not planned so most patients are new to the hospital, making identification challenging.

Finally, implementation is very time-consuming. *ED 1* and *PC 1* had the advantage of an extra year of exploration. Although they faced many setbacks and false starts, the extra time afforded them the opportunity to recover. When the remaining sites faced unexpected challenges, including difficulties achieving buy-in at the site and bureaucratic hurdles (e.g. contract delays, ethics approvals), they were left with less time to complete the installation and implementation of the intervention. The shift from project to sustainable practice was a hurdle that required time to achieve. If all the sites had equal time to implement, the results may have been different.

> For me it really reinforced what I already knew, which is that this kind of stuff takes time and that it works best if you can build that enthusiasm and if you have a champion and that it can go wrong pretty, pretty easily. (Allied health worker, PC 3)

Discussion

This study explored barriers and facilitators to improving health care for adults with IDD, a group with high health complexity and high rates of health care utilization. Despite the acknowledged importance of improving care for this group and the structured implementation supports provided, all sites reported challenges and varied levels of implementation were achieved across sites.

An initial challenge was site buy in- i.e. achieving site agreement to proceed with the implementation. There are always a multitude of projects competing for attention and interventions that target a small number of patients can be perceived as having a smaller payoff. To address this, additional work was needed to demonstrate the value of this intervention and the presence of facilitators including alignment with site mandate, strong champions, a pre-existing focus on IDD and the existence of national guidelines, was important to allow the site to move forward. This aligns with previous research which found that a key barrier to uptake of primary care improvement for patients with IDD was low perceived value of the intervention.[9]

Most of the study sites achieved initial implementation but, at study end, sustainability seemed uncertain at all but one of the sites. This occurred in part because, due to the nature of this population, staff received relatively low exposure to the intervention. Most clinicians see patients with IDD relatively infrequently, giving them few opportunities to 'practice' the intervention and incorporate it into their routine. We found that without some type of reminder mechanism, it was unlikely staff would remember to provide the intervention, and how to do so. Site feedback indicated the use of automated electronic reminders and clinical prompts to be immensely helpful in supporting intervention delivery; follow-up can determine how successful this strategy is in supporting long-term sustainability.

Beyond these challenges, many of the same barriers and facilitators generally identified in the implementation literature,[32-34] were also reported by the study sites. Higher implementing sites benefited from strong champions, alignment with site mandate, research or quality improvement capacity, and sufficient staff resources. Lower implementing sites were challenged by low morale, staff turnover, low staff engagement, passive endorsement from leadership, staff with insufficient skills or authority leading the project and insufficient time to implement. Previous studies on implementing practice change for patients with IDD identified some similar barriers including lack of resources, lack of leadership support, insufficient funding and low perceived value.[9,24]

To support spread of this intervention, there are several system level strategies that can offset some of the challenges above, reduce the burden on individual organizations and facilitate wider implementation. Almost all study sites emphasized the critical role played by the central team, suggesting that spread would require ongoing implementation support to provide information, keep resources updated and help sustain momentum.

Implementation could also be supported by a central IDD patient registry, as has

been established in other jurisdictions.[36] This would help ensure the often-invisible segments of the IDD population with more mild disabilities are identified. A registry could be linked to EMRs, facilitating identification in busy EDs where it is challenging and eliminating the need for labour intensive manual reviews of patient rosters in PCs, the method used by the study PC sites.

Another central support strategy is for EMR vendors to centrally incorporate IDD specific point-of-care tools and automated prompts, thereby reducing the need for each site to do so individually. At most study sites expanding EMR function required extensive time and sites without the resources to make these changes were uniformly less successful in their implementation efforts. This would be easier to accomplish in jurisdictions or sectors with a single common EMR platform.

Adults with IDD often require longer appointments, which can be a barrier for physicians reimbursed in fee-for-service models. Incentive payments are already used in Ontario for specific procedures (e.g. cancer screening) and may be a valuable strategy related to this population. Though studies from jurisdictions where financial incentives are available suggest that, while they can be beneficial, they alone are insufficient to achieve change.[12,37]

This intervention could also be supported by improvements in medical, nursing and other clinical training programs which currently include relatively little content on IDD.[12,24,38,39] However, even with improved education, adults with IDD are a complex group and it may not always be possible for generalist teams to fully support them. Both ED and PC settings may benefit from working with clinicians who specialize in treating adults with IDD. One potential model to consider is the learning disability liaison nurse role used in the UK. The nurse liaison is a dedicated role that supports improved care for individuals with IDD in hospitals, either through direct care or by supporting the care team. Current research in this area is limited, but generally positive on the effectiveness of this model.[24,40,41] Primary care delivery could be supported by a referral or consultation model with IDD specialized PC practices.[12] The combination of improved education for all clinicians and access to support from IDD specialists could support widespread capacity for high quality care in generalist settings.

Strengths and limitations

Relatively few previous studies, and no Canadian studies, have examined barriers and facilitators to improving emergency and primary care for adults with IDD. To the best of our knowledge, this is the first study in any jurisdiction that has used a structured, staged implementation approach to improve care for this population, an approach that has been shown to improve implementation success. A strength of this study is that it included sites from three diverse localities across Ontario; however, each of these sites exists within a specific context and findings may not apply to other contexts. This effort was part of a grant which included commitment from sites to participate at the time of grant submission. It is likely that implementation success would be lower in a random sample.

This study focused on organizational and system level factors affecting implementation; we did not collect data on individual staff characteristics (the fifth CFIR domain) which may have identified additional barriers or facilitators to implementation. It was also not within the scope of this study to look at intervention outcomes. The next step in this ongoing work will be to engage with patients with IDD and their families, as well as providers, to discover if the new practices are effectively meeting patient needs and improving patient outcomes.

Conclusion

Providing effective and appropriate care to all is critical to improving population health outcomes but is challenging to achieve for small, complex groups, such as adults with IDD. Given the time-consuming, resource-intensive nature of implementation, and the importance of providing evidence-based care, it is critical we understand the factors associated with success. This study identifies some of the barriers and facilitators associated with successful practice improvement for adults with IDD in emergency and primary care settings. Particularly key for sites that made more progress were presence of strong champions, project alignment with site priorities, and use of electronic reminders. This study is an important addition to literature on implementing best practices for adults with IDD and may also have relevance for other low prevalence populations.

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Conflicts of interest

The authors have no conflicts of interest to disclose.

Authors' contributions and statement

YL conceived the project. JD, JL, IC and YL designed the study. AS led data collection, analysis and writing of the manuscript. JD and YL contributed to data synthesis. All authors discussed the results/interpretation, contributed to writing and approved the final manuscript.

The content and views expressed in this article are those of the authors and do not necessarily reflect those of the Government of Canada.

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Original quantitative research

Breast cancer detection method, diagnostic interval and use of specialized diagnostic assessment units across Ontario, Canada

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Abstract

Introduction: Breast cancer is detected through screening or through signs and symptoms. In Canada, mammograms for breast cancer screening are offered in organized programs or independently (opportunistic screening). Province of Ontario breast Diagnostic Assessment Units (DAUs) are facility-based programs that provide coordinated breast cancer diagnostic services, as opposed to usual care, in which the primary care provider arranges the tests and consultations. This study describes breast cancer detection method, diagnostic interval and DAU use across Ontario.

Methods: The study cohort consisted of 6898 women with invasive breast cancer diagnosed in 2011. We used the Ontario Cancer Registry linked to administrative health care databases. We determined the detection method using the Ontario Breast Screening Program (OBSP) data and physician claims. The diagnostic interval was the time between the initial screen, specialist referral or first diagnostic test and the cancer diagnosis. The diagnostic route (whether through DAU or usual care) was determined based on the OBSP records and biopsy or surgery location. We mapped the diagnostic interval and DAU coverage geographically by women's residence.

Results: In 2011, 36% of Ontario breast cancer patients were screen-detected, with a 48% rate among those aged 50 to 69. The provincial median diagnostic interval was 32 days, with county medians ranging from 15 to 65 days. Provincially, 48.4% were diagnosed at a DAU, and this ranged from zero to 100% across counties.

Conclusion: The screening detection rate in age-eligible breast cancer patients was lower than published population-wide screening rates. Geographic mapping of the diagnostic interval and DAU use reveals regional variations in cancer diagnostic care that need to be addressed.

Keywords: breast neoplasms/diagnosis, female, diagnostic services, early detection of cancer, early diagnosis, cross-sectional studies, health services research

Highlights

- In 2011, 48.4% of female breast cancer patients in Ontario who were age-eligible for screening had their cancers detected through screening.
- The median time to breast cancer diagnosis was 4.6 weeks.
- There was substantial geographic variation in the diagnostic interval and in the use of Diagnostic Assessment Unit (DAU) services across Ontario.

Introduction

Screening is important for achieving an early diagnosis of cancer and thereby improving the chance of survival.[1] In Canada, mammograms for breast cancer screening are offered by organized programs or independently (opportunistic screening).[2] The breast screening participation rate in the screen-eligible population is viewed as an important indicator of a screening program's effectiveness and is routinely monitored by organized programs.[3] But a high screening participation rate does not necessarily mean that all breast cancers are detected by the screening program. In fact, many are detected when the patient presents to her doctor with breast cancer signs or symptoms.[4] Documentation of the proportion of breast cancer patients detected by screening (vs. symptomatic presentation) is lacking.

The breast cancer diagnostic period is characterized by multiple appointments for diagnostic tests and consultations and it often provokes considerable distress and anxiety for women and their families.[5-7] A diagnostic delay of three months or more can lead to advanced cancer stage and lower chances of survival.[8] The 2007 guideline for monitoring breast screening program performance recommended 90% of abnormal screening results should be

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resolved within 5 weeks, or within 7 weeks if a tissue (core or open) biopsy is required.[9] Consequently, the time interval from an abnormal screen to a final diagnosis is routinely assessed against the national targets by organized programs. In 2011, the Ontario Breast Screening Program (OBSP) reported significant regional variation in meeting the national timeliness target for women with abnormal screens.[3] However, little is known about the length of the diagnostic interval at the population level and whether it varies in different regions of the province.

Ontario Diagnostic Assessment Units (DAUs) are innovative, facility-based programs designed to improve the timeliness and quality of diagnostic care services.[7] Similar initiatives exist in many jurisdictions around the world.[10,11] Ontario breast DAUs take two forms: organized Breast Assessment Affiliates (BAAs),[12] and regionally developed breast assessment centres. Diagnostic care at BAAs is provided by a multidisciplinary health care team that includes a nurse navigator who coordinates the process. This differs from the usual care diagnostic route (UC) where the patient's primary care provider plays a central role in arranging referrals and recommending appropriate diagnostic assessments and specialist consultations.[12-14] The nurse navigator also provides patient psychological and informational support. Each designated facility has to meet minimum organizational criteria regarding breast cancer diagnostic service resources and availability to maintain its BAA status.[13] The diagnostic process at regional breast assessment centres is less well documented, but those centres have similar goals and structures to those of the BAAs.

This study aimed to describe, among all Ontario breast cancer patients: 1) the cancer detection method; 2) the length of the diagnostic interval and its geographic pattern; and 3) the coverage of DAU services and its geographic pattern. This is one of three reports arising from our population-based study on DAU use and the diagnostic interval.[14-16]

Methods

Study population

The study population consisted of women with a first primary invasive breast cancer diagnosed in 2011 in Ontario, Canada. We excluded: 1) those whose cancer registry record could not be linked to administrative data; 2) those who were living outside of Ontario at the time of diagnosis; and 3) those who did not have Ontario Health Insurance Plan (OHIP) coverage for at least three years prior to diagnosis.[14,15]

Data sources

Study data included the Ontario Cancer Registry linked to administrative databases at the Institute for Clinical Evaluative Sciences (ICES) and Cancer Care Ontario (CCO). We used the Ontario Cancer Registry to identify breast cancer cases and determine the date of diagnosis. The Collaborative Stage Data provided information on cancer stage and histology. We defined stage at diagnosis using the TNM classification, 7th edition.[17,18] The OBSP database provides information on screening date, screening test results and use of BAAs. The OHIP claims database, the National Ambulatory Care Reporting System (NACRS), the Canadian Institute for Health Information Discharge Abstract Database (CIHI-DAD) and the Same-Day Surgery Database (CIHI-SDS) contain information on breast cancer diagnostic procedures and associated dates and physicians. A list of BAA hospitals was provided by the OBSP and we developed a separate list of regional breast assessment centres by conducting an email survey among CCO Regional Primary Care Leads and OBSP Regional Program Managers.

Detection method, diagnostic interval and DAU use definitions

We determined screen-detected cancers by looking back 12 months from the date of the cancer diagnosis for abnormal OBSP screens and 6 months for opportunistic screens. We assumed a patient presented with signs or symptoms if her cancer was not screen-detected. We shortened the look-back time window to 6 months from 12 months when identifying opportunistic screens because those screens were identified using billing claims, which do not contain test results (which were available in the OBSP database). This 6-month window was based on Canadian guideline evidence[9,19] and our observation that fewer than 5% of abnormal OBSP screens occurred in the 6 to 12 months before diagnosis.[15]

We defined the diagnostic interval as the number of days from the date of the cancer diagnosis back to the initial screen, or referral to a specialist or the first diagnostic test in the absence of a screening test (Figure 1). This strategy is an adaptation of one used in colorectal cancer.[20] The cancer diagnosis date was contained in the Ontario Cancer Registry and is normally the first occurrence of a histology- or cytology-confirmed malignancy or a hospital admission or outpatient consultation. The diagnostic interval was analyzed as both a continuous and a dichotomous outcome at 7 weeks, with the latter based on the longer of the two timeliness targets mentioned above.[9,19]

We determined DAU use for patients who had an initial screen within the OBSP (OBSP patients) separately from the rest, because the OBSP has a database that tracks the use of the Breast Assessment Affiliates. The OBSP patients were considered to be diagnosed through a DAU if they had either an OBSP BAA payment record or a biopsy/surgery performed at a DAU hospital. Otherwise, they were considered to be diagnosed through the UC. The remaining patients (opportunistically screened and symptomatic patients) were considered to be diagnosed through a DAU if they had a biopsy/surgery performed at a DAU hospital. We validated this strategy using the OBSP record as the criterion standard and found that using the biopsy/surgery hospital had a sensitivity of 90.1% and a specificity of 84.6%.[15]

Statistical analysis

We used proportions to describe the breast cancer screening detection rates and DAU use. Screening detection rates were categorized into three age groups (< 50 years, 50–69 years, > 69 years) based on the most recent Canadian guideline at the time of this study, although the updated guideline increased the upper age limit for screening to 74 in November of 2011.[21] We report the median diagnostic interval because its distribution is right-skewed. We report the diagnostic interval and DAU coverage by Local Health Integration Network (LHIN) and by county, both based on the patient's residence location at diagnosis. The county-level diagnostic interval was categorized for mapping purposes with category cut-points chosen to ensure a reasonable number of counties within each category. DAU service coverage was also categorized for mapping. To assess whether adjacent counties could be combined, we calculated a spatial autocorrelation

FIGURE 1
Measurement of the breast cancer diagnostic interval

A. Date of the first OHIP screening mammogram in 6 months before diagnosis or the first abnormal OBSP screening test in 12 months before diagnosis
Date of the first OHIP screening mammogram in 6 months before diagnosis or the first abnormal OBSP screening test in 12 months before diagnosis
B. Date of the last visit with the ordering physician prior to the date of diagnostic mammogram
Claim # of the ordering physician
Date of the first diagnostic mammogram in 6 months prior to diagnosis
C. Date of the last visit with the ordering physician prior to the date of breast ultrasound
Claim # of the ordering physician
Date of the first breast ultrasound in 6 months prior to diagnosis
index contact date = the earliest of A (if A did not exist, take the earliest of B, C, D, E, F or G)
D. Date of the last visit with the ordering physician prior to the date of breast MRI
Claim # of the ordering physician
Date of the first breast MRI in 6 months prior to diagnosis
Date of the breast cancer diagnosis
E. Date of the last visit with the ordering physician prior to the date of breast biopsy
Claim # of the ordering physician
Date of the first breast biopsy in 6 months prior to diagnosis
F. Date of the last visit with the ordering physician prior to the date of breast surgeon consultation
Claim # of the ordering physician
Date of the first surgeon consultation in 6 months prior to diagnosis
G. Date of the first breast cancer–related ED visit in 6 months prior to diagnosis
Date of the first breast cancer–related ED visit in 6 months prior to diagnosis

Source: Based on methodology outlined in Singh et al.[20]

on the diagnostic interval using the Global Moran's I statistic, which takes the values between −1 (perfect spatial dispersion) to 1 (perfect spatial clustering), with 0 representing a random geographic pattern.[22] For the county-level analysis, we conducted univariable and multivariable median regressions to assess the unadjusted and stage-adjusted geographic variation in the diagnostic interval because earlier stage at diagnosis has repeatedly been shown to be associated with a longer diagnostic interval.[23] We received ethics approval from the Health Sciences and Affiliated Teaching Hospitals Research Ethics Board at Queen's University at Kingston, Ontario, Canada.

Results

The final cohort size was 6898. The flow chart depicting the cohort selection process is shown in Figure 2. The mean age was 61.2 (SD: 13.5).

Of the 6898 patients, 2499 (36.2%) were screen-detected and 4399 (63.8%) were symptomatic. Table 1 reports screening detection rates by age group. Of screen-detected patients, 1986 (79.5%) were screened via the OBSP and 513 (20.5%) were screened opportunistically.

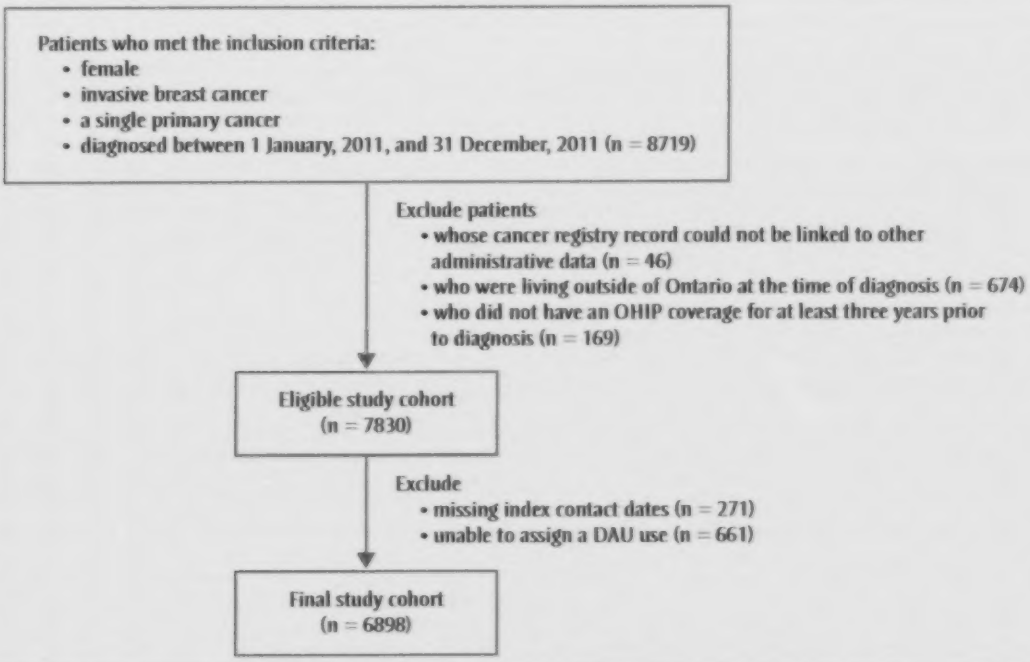
The provincial median time to diagnosis was 32 days (interquartile range: 17–60). Sixty-eight percent of breast cancer patients were diagnosed within the 7-week target, while 10% waited 107 days or more. Nearly half (48.4%) of patients were diagnosed at a DAU.

Table 2 describes the diagnostic interval and DAU use by LHIN. The median diagnostic interval ranged from 24 days (95% CI: 20.6–27.4) in the South East LHIN to 41 days (95% CI: 34.7–47.3) in the North West LHIN ($p < .001$). The percent of women diagnosed through a DAU varied from 2.6% (95% CI: 0.7%–4.6%) in the North Simcoe Muskoka LHIN to 93% (95% CI: 90.2%– 95.8%) in the South East LHIN ($p < .001$), reflecting regional differences in DAU availability.

Figure 3 further maps the median diagnostic interval across Ontario counties. There was no evidence of a spatial correlation in the diagnostic interval (Global Moran's I = −0.02, $p = .95$), indicating that grouping neighbouring counties, as is done when reporting by LHIN, masks variation. Counties with the longest diagnostic intervals were scattered across the province, and patients in the most populous area (Greater Toronto Area) experienced waits in the second longest category. As Table 3 shows, 13 counties out of 47 (two counties with small numbers are not reported) had a median diagnostic interval greater than 7 weeks, and the median ranged from 15 days (95% CI: 7.6–22.4) to 65 days (95% CI: 39.6–90.4). This variation did not materially change with stage adjustment (results not shown).

Figure 4 maps county-level DAU service use across Ontario. Rates range from 0% to 100%, partially reflecting that, at the time of this study, DAUs did not exist in 19 (38.8%) counties (see Table 3). Of these 19, 11 had a median diagnostic interval

FIGURE 2
Cohort selection process


Patients who met the inclusion criteria:
• female
• invasive breast cancer
• a single primary cancer
• diagnosed between 1 January, 2011, and 31 December, 2011 (n = 8719)
Exclude patients
• whose cancer registry record could not be linked to other administrative data (n = 46)
• who were living outside of Ontario at the time of diagnosis (n = 674)
• who did not have an OHIP coverage for at least three years prior to diagnosis (n = 169)
Eligible study cohort (n = 7830)
Exclude
• missing index contact dates (n = 271)
• unable to assign a DAU use (n = 661)
Final study cohort (n = 6898)

greater than or equal to the provincial median.

Discussion

To the best of our knowledge, this is the first Ontario study and among the first Canadian studies describing breast cancer screening detection rates and waiting time to diagnosis in a population-based breast cancer cohort.[24,25] Previous Ontario reports have been restricted to those seen within organized breast cancer screening programs[12,26] while our study also includes the 63.8% of breast cancer patients who were diagnosed symptomatically and the 7.4% detected through opportunistic screening.

Our observed screening detection rate (48.4% in those breast cancer patients aged 50–69 years) was lower than the general population screening participation rates reported by the OBSP. In calendar years 2007 and 2008, the OBSP calculated that 66.3% of the Ontario women aged 50 to 69 years had been screened (through OBSP or opportunistic screening),[27] and the coverage was estimated to be similar in 2011.[3] The discrepancy between screening program participation rates and screening detection rates aligns with evidence that those at higher risk with breast cancer risk factors such as higher age and lack of exercise are less likely to get screened[28] and that some women are being diagnosed between screenings. To this latter point, Kirsh et al. estimated that 13.8% of breast cancer patients nested within a cohort of OBSP participants from 1994 to 2002 were diagnosed within 24 months after a negative screening mammogram (known as interval cancers).[29]

The only other Canadian evidence on the breast cancer screening detection rate comes from two recent studies in Alberta, with one reporting that 44% of all breast cancers were detected through screening from 2007 to 2010[14] and the other reporting a screening detection rate of 38% from 2004 to 2010[25] (we observed 36% in Ontario in 2011). Screening eligibility criteria differ between the two provinces, as the Alberta Breast Cancer Screening Program additionally accepts patients aged 40 to 49 years.[30] However, the biennial breast cancer screening participation rate (programmatic and nonprogrammatic) for women aged 50 to 69 years is lower in Alberta (55.1%–57.3% in 2007–2010)[31] than Ontario (66.3% in years 2007–2008).[27]

Two population-based studies conducted in United States reported the proportions of screen-detected cancer at 22% and 30.2%, respectively,[32,33] with the latter restricted to women aged 40 to 49 years. These lower rates may have changed since these studies were conducted in the 1990s. A more recent study in Mexico[34] reported a screening detection rate of

TABLE 1
Breast cancer detection method rates by age group, Ontario, Canada, 2011 (N = 6898)

Age group	Screen-detected	Symptomatic
	Total (row %)	Total (row %)
< 50 years	158 (11.1)	1270 (88.9)
50–69 years	1736 (48.4)	1851 (51.6)
> 69 years	605 (32.1)	1278 (67.9)
All ages (total)	2499 (36.2)	4399 (63.8)

TABLE 2
Descriptive statistics of the breast cancer diagnostic interval and diagnostic assessment unit coverage by Local Health Integration Network, Ontario, Canada, 2011 (N = 6898)

LHIN	n	Diagnostic interval median (95% CI)	DAU coverage rate[a] (95% CI)
Erie St. Clair	412	27.5 (25.1–30.0)	81.6 (77.8–85.3)
South West	594	35.0 (30.6–39.4)	81.6 (78.5–84.8)
Waterloo Wellington	380	30.0 (27.9–32.1)	51.3 (46.3–56.3)
Hamilton Niagara Haldimand Brant	697	29.0 (27.7–30.3)	53.4 (49.7–57.1)
Central West	311	37.0 (33.7–40.3)	12.9 (9.1–16.6)
Mississauga Halton	571	36.0 (32.4–39.6)	29.1 (25.3–32.8)
Toronto Central	553	34.0 (30.8–37.2)	37.4 (33.4–41.5)
Central	863	36.0 (33.3–38.7)	21.2 (18.5–23.9)
Central East	740	35.5 (34.3–36.6)	38.0 (34.5–41.5)
South East	315	24.0 (20.6–27.4)	93.0 (90.2–95.8)
Champlain	758	29.0 (27.8–30.2)	69.5 (66.2–72.8)
North Simcoe Muskoka	266	29.8 (23.7–35.8)	2.6 (0.7–4.6)
North East	316	28.0 (25.3–30.7)	45.6 (40.1–51.1)
North West	120	41.0 (34.7–47.3)	80.8 (73.8–87.9)
Unknown/shared LHINs	—	—	—

Abbreviations: CI, confidence interval; DAU, diagnostic assessment unit; ICES, Institute for Clinical Evaluative Services; LHIN, Local Health Integration Network.

Note: — indicates cells with counts less than 10, which were not reported due to ICES privacy regulations.

[a] Calculated as the percent of patients diagnosed through DAU for each LHIN.

58.3% among breast cancer patients of all ages. This higher rate may be partly attributed to a more liberal definition of "screen-detected cancer": cancer diagnosed within 270 days of a bilateral (both breasts) screening mammogram.

Waiting for a diagnosis can have considerable psychological consequences for patients and their families and wait time reductions can significantly reduce anxiety levels.[6] In Canada, there is little guidance about breast cancer diagnostic wait times; breast cancer screening timeliness targets at the time of this study recommended that 90% of abnormal screenings should be resolved within 5 weeks, or within 7 weeks if a tissue biopsy is performed.[9] Applying the more liberal 7-week cut, we observed that 68.3% of breast cancer patients in our study were diagnosed within 7 weeks. Our observed rate is similar to a 64% rate reported in 2010 for resolution of all Ontario abnormal breast cancer screens requiring a tissue biopsy.[30]

In our study, the median breast cancer diagnostic interval for Ontario in 2011 was 4.6 weeks (32 days), and 690 patients (10%) waited 3.6 months or longer, which is a level of delay that has been associated with worse survival.[8] Our observed median was shorter than the reported median time from an abnormal screen to diagnosis requiring tissue biopsy for other Canadian provinces in the year 2010 (range: 5–7 weeks).[30] This is likely explained by our restriction to the cancer population. We reported the diagnostic interval separately for the screen-detected and the symptomatic breast cancer patients in two companion papers,[14,16] with medians of 29 days and 34 days, respectively. Our observations differed from findings in Alberta, which reported medians of 19 days for the screen-detected patients and 21 days for the symptomatic patients in the years 2004 to 2010.[25]

Within Ontario, we observed significant regional variation in the diagnostic interval. The maximum difference was 2.4 weeks (17 days) between LHINs. Women who live in the North West, Central West and Mississauga Halton LHINs experienced the longest waits, exceeding 5 weeks. In 2011, the OBSP reported that these regions were among those that had the lowest 7-week tissue biopsy target rates.[5] Reasons for these low rates likely vary across these three LHINs as they are very different geographically and demographically. Further study is required to better understand these differences.

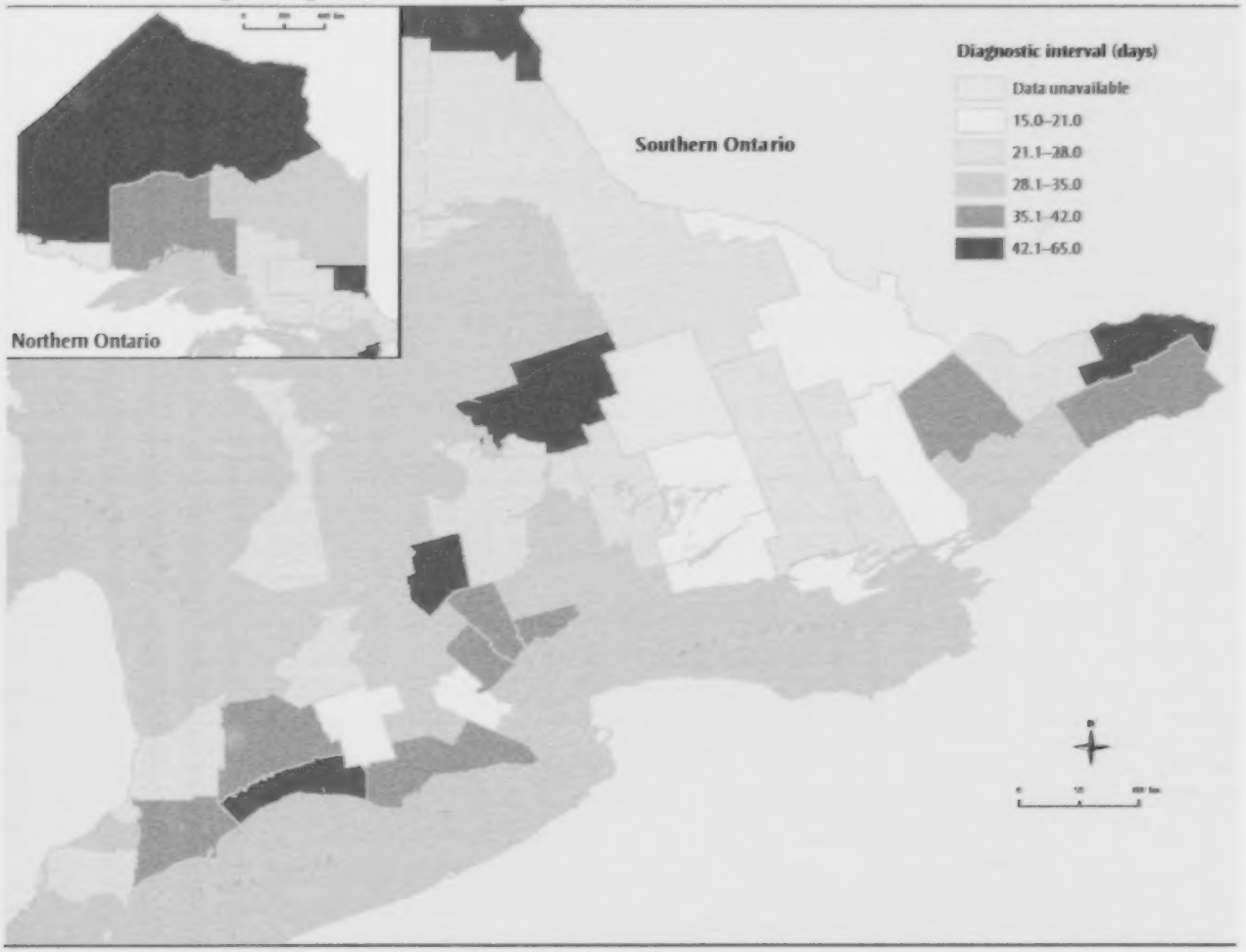
Compared to the LHIN-level analysis, we observed greater variation between counties; there was a maximum difference of 7.1 weeks (50 days) between counties, indicating intra-LHIN variation. Consistent with the LHIN-level findings, the longest diagnostic intervals were observed in both the most populous (Greater Toronto Area) and the least populous (northern Ontario) areas. We also observed significant variation in DAU service use across counties. The county with 0% of DAU use had the longest diagnostic interval at both the median (65 days) and 75th percentile (108 days), and the county where 100% of patients used DAU service had a median diagnostic interval (27 days) that was among the shortest.

We previously hypothesized that the variation in the diagnostic interval may be partially attributable to different DAU service availabilities across regions.[14,15] We found that DAU use was associated with reduced time-to-diagnosis for both screen-detected and symptomatic patients after control for potential confounders in multivariable analyses.[14,16] It should be noted that other regional factors such as patient demographics, care referral processes and local programs may have contributed to the variation that we have observed, since regions with high DAU coverage are not consistently associated with shorter diagnostic intervals. The World Health Organization has identified geographic variation as a health care quality concern pertinent to two dimensions: equity and accessibility.[35] Therefore, the reasons for this observed variation warrant further investigation in order to improve access and equity of breast cancer diagnostic care.

Strengths and limitations

This study has several strengths. We have demonstrated the feasibility of using routinely collected health administrative data to understand the breast cancer diagnostic process. Our approach provides methodological guidance for determining breast cancer detection method, diagnostic interval and use of specialized breast diagnostic assessment units that may be adapted for use over time in Ontario and in other Canadian provinces. This is the first Ontario study to provide population-based evidence on the breast cancer screening detection rate, diagnostic interval and use

FIGURE 3
Length of diagnostic interval among breast cancer patients across counties, Ontario, Canada, 2011



of diagnostic assessment units. This population-wide information highlighted the low screening detection rate (36%) when breast cancer patients of all ages are considered, and it provides a full picture of the breast cancer experience by including those who are opportunistically screened and those who presented symptomatically: groups who are routinely excluded from breast cancer diagnostic studies. Therefore, our findings provide a unique population perspective on the role of breast cancer screening in cancer detection, access to DAUs and the amount of time it takes for a diagnosis, which can inform cancer program policies and interventions and their evaluation. The geographic variations we observed provide important information for system administrators to compare across regions and identify successful regional initiatives for wider implementation. This information could prompt knowledge sharing and facilitate collaboration across regions aimed at improving the timeliness of care and, ultimately, patients' experience. The existence of such wide variation at a county level is a caution to other health care systems.

This study also has a number of limitations. First, we did not estimate the time-to-diagnosis or time-to-resolution interval for all patients being investigated for breast cancer, but instead focussed on the group who were ultimately diagnosed with the disease. Although patients under investigation are identifiable in the screening program, they are much harder to find in administrative data, which we needed in order to include patients who presented symptomatically. Evidence suggests that women with invasive breast cancer get a quicker diagnosis compared to those with benign diseases,[36,37] so the intervals we report are likely shorter than the benign group would experience and therefore apply only to women with breast cancer.

Second, we did not have test results in the administrative databases, so a small portion of the 7.4% whom we considered as being opportunistically screened may have actually had a negative screening mammogram, making our estimate of their diagnostic interval longer than it actually was and erroneously labelling that small group as having been screen-detected. Conversely, a small proportion of apparently symptomatic patients may have had an abnormal opportunistic screening test more than 6 months before diagnosis, thereby underestimating their

TABLE 3
Descriptive statistics of the breast cancer diagnostic interval and diagnostic assessment unit coverage by county, Ontario, Canada, 2011 (N = 6898)

County	n	Diagnostic interval median (95% CI)	DAU coverage rate[a] (95% CI)
Brant County*	60	31.0 (23.8–38.2)	6.6 (0.4–13.0)
Bruce County*	46	21.9 (14.6–29.2)	73.9 (61.2–86.6)
Dufferin County*	30	46.9 (32.5–61.3)	6.7 (−2.3–15.59)
Elgin County*	59	49.0 (36.2–61.8)	18.6 (8.7–28.6)
Essex County	251	25.0 (20.8–29.2)	85.7 (81.3–90.0)
Frontenac County	89	21.0 (17.7–24.3)	98.9(96.7–101.1)
Grey County	63	30.0 (23.3–36.7)	76.2 (65.7–86.7)
Haldimand-Norfolk Regional Municipality*	68	37.8 (32.6–43.0)	17.6 (8.6–26.7)
Haliburton County*	—	—	—
Halton Regional Municipality*	215	36.0 (30.1–41.9)	26.0 (20.2–31.9)
Hastings County	89	22.0 (16.4–27.6)	96.6 (92.9–100.4)
Huron County*	36	30.1 (18.0–42.3)	88.9 (78.6–99.2)
Chatham-Kent Division	62	40.5 (23.9–57.1)	91.9 (85.2–98.7)
Lambton County	98	25.4 (15.5–35.3)	64.3 (54.8–73.8)
Lanark County*	41	38.0 (30.5–45.5)	53.7 (38.4–68.9)
Leeds and Grenville United Counties	68	31.7 (26.1–37.3)	86.8 (78.7–94.8)
Lennox and Addington County*	19	27.0 (9.5–44.5)	100.0 (100.0–100.0)
Toronto Division	1289	38.0 (36.0–40.0)	25.5 (23.1–27.9)
Middlesex County	285	42.0 (36.6–47.4)	94.0 (91.3–96.8)
Muskoka District Municipality*	49	65.0 (39.6–90.4)	0.0 (0.0–0.0)
Niagara Regional Municipality	241	35.0 (31.3–38.7)	90.9 (87.2–94.5)
Northumberland County	57	20.0 (13.7–26.3)	94.7 (88.9–100.5)
Durham Regional Municipality	283	33.0 (28.6–37.4)	54.1 (48.3–59.9)
Ottawa Division	549	28.0 (24.2–31.8)	74.7 (71.0–78.3)
Oxford County	62	16.4 (10.7–22.1)	85.5 (76.7–94.3)
Peel Regional Municipality	567	37.0 (34.0–40.0)	27.5 (23.8–31.2)
Perth County	43	23.0 (15.5–30.5)	100.0 (100.0–100.0)
Peterborough County	73	20.0 (14.3–25.7)	41.1 (29.8–52.4)
Prescott and Russell United Counties	52	48.7 (36.9–60.5)	48.1 (34.5–61.7)
Prince Edward Division	19	15.0 (7.6–22.4)	94.7 (84.7–104.8)
Renfrew County	51	15.0 (6.8–23.2)	90.2 (82.0–98.4)
Simcoe County	245	24.0 (19.4–28.6)	4.1 (1.6–6.6)
Stormont, Dundas, Glengary United Counties	74	40.8 (32.3–49.2)	36.5 (25.5–47.5)
Kawartha Lakes Division	45	23.0 (10.6–35.4)	28.9 (15.6–42.1)
Waterloo Regional Municipality	281	30.0 (26.8–33.2)	61.9 (56.2–67.6)
Wellington County*	94	32.0 (27.5–36.5)	19.1 (11.2–27.1)
Hamilton Division	266	19.7 (16.5–22.9)	41.0 (35.1–46.9)
York Regional Municipality	528	32.0 (28.8–35.2)	23.9 (20.2–27.5)
Algoma District	68	24.0 (13.5–34.5)	88.2 (80.6–95.9)

Continued on the following page

diagnostic interval (and erroneously labelling them as having been symptomatic at presentation).

Third, defining the symptomatic index contact date as the most recent referring physician visit preceding the earliest test procedure was a conservative choice regarding the calculation of the diagnostic interval because the actual referral may have occurred earlier.

Fourth, new physician billing codes that specify the reason for the mammogram (symptomatic vs. asymptomatic) were introduced on 1 October, 2010, and may not have been fully adopted by the time of our study. Therefore, some opportunistically screened patients may be misclassified as symptomatic and thus we may have underestimated the proportion of screen-detected patients. We expect this influence to be small, because the frequency of use of this new code increased dramatically during the first three months of its introduction and had levelled off by the time of this study.[38]

Finally, the determination of DAU use was subject to misclassification, with the sensitivity estimated at 90.1% and specificity at 84.6%.[15]

Conclusion

This report provides diagnostic access information about those who are ultimately diagnosed with a breast cancer. Among age-eligible breast cancer patients, we observed lower screening detection rates than screening participation rates in the general population. This result suggests that future cancer screening efforts should target women at increased risk of breast cancer and/or that the rate of interval cancers is in need of improvement. We also observed considerable variation in the length of diagnostic interval and DAU across geographic regions. There is a need for further research to understand the factors attributable to this variation and identify opportunities for system improvement. Finally, future efforts to understand diagnostic wait times and the influence of programs designed to mitigate them must occur at the population level rather than be restricted to organized screening programs.

Acknowledgements

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TABLE 3 (continued)
Descriptive statistics of the breast cancer diagnostic interval and diagnostic assessment unit coverage by county, Ontario, Canada, 2011 (N = 6898)

County	n	Diagnostic interval median (95% CI)	DAU coverage rate[a] (95% CI)
Cochrane District	42	35.0 (28.0–41.9)	38.1 (23.4–52.8)
Kenora District[b]	31	50.0 (30.8–69.2)	41.9 (24.6–59.3)
Manitoulin District[b]	14	19.7 (6.3–33.2)	50.0 (23.8–76.2)
Nipissing District[b]	53	22.0 (13.2–30.8)	13.2 (4.1–22.3)
Parry Sound District[b]	28	32.5 (19.6–45.3)	17.9 (3.7–32.0)
Rainy River District[b]	—	—	—
Greater Sudbury Division	87	24.0 (18.1–29.9)	46.0 (35.5–56.4)
Sudbury District[b]	15	22.0 (2.9–41.1)	40.0 (15.2–64.8)
Thunder Bay District	84	40.0 (34.8–45.2)	97.6 (94.4–100.9)
Timiskaming District[b]	11	53.0 (14.2–91.8)	36.4 (7.9–64.8)

Note: — indicates cells with counts less than 10, which were not reported due to Institute for Clinical Evaluative Services (ICES) privacy regulations.
[a] Calculated as the percent of patients diagnosed through DAUs for each county.
[b] Counties without a DAU.

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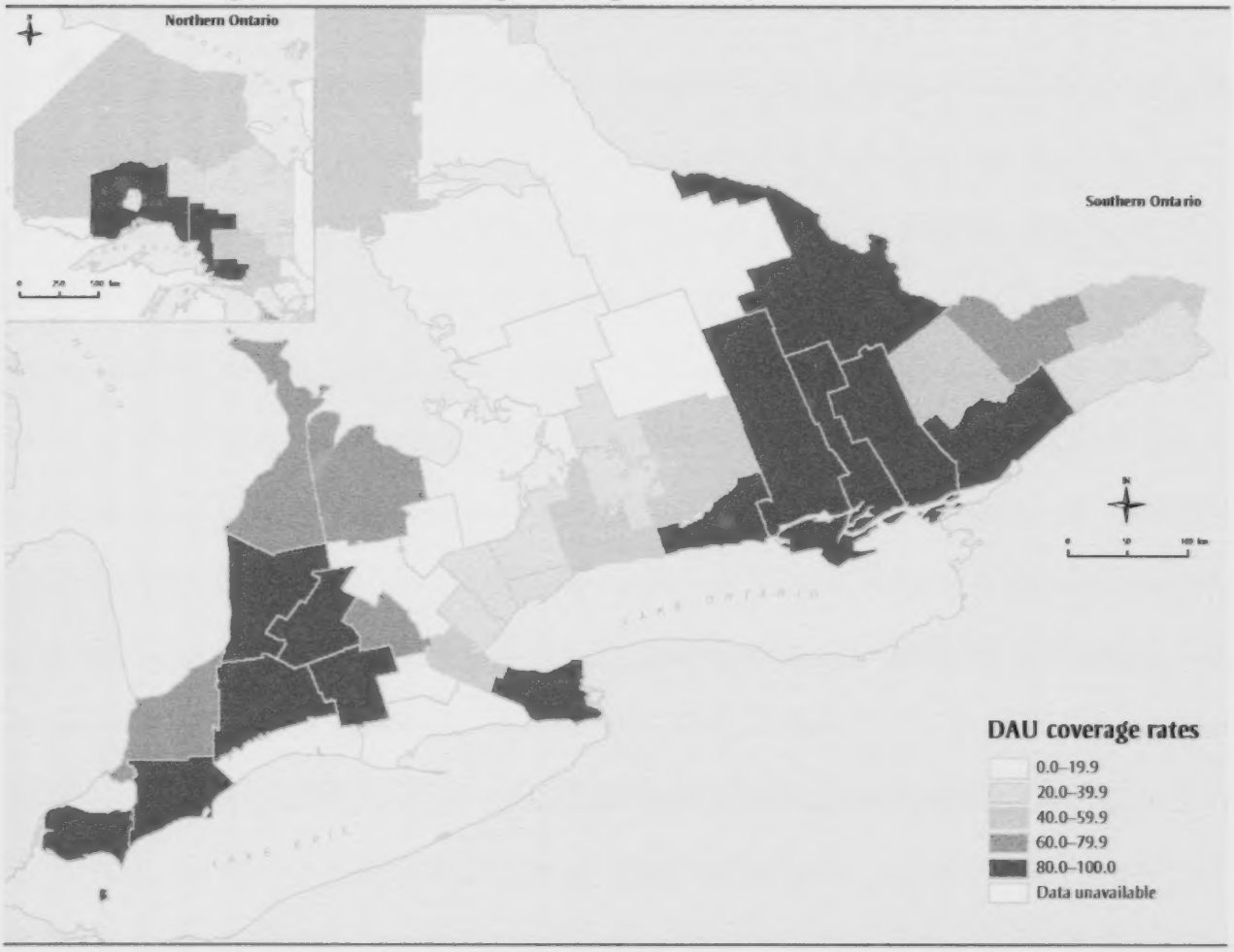
FIGURE 4
Ontario breast diagnostic assessment unit coverage rate among breast cancer patients across counties, Ontario, Canada, 2011



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Conflicts of interest

The authors declare no conflicts of interest.

Authors' contributions and statement

All authors contributed to study design, results interpretation and manuscript revision. PG oversaw the research methodology. LJ performed analysis and had a major role in drafting and revising the manuscript.

The content and views expressed in this article are those of the authors and do not necessarily reflect those of the Government of Canada

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Original quantitative research

The association of school connectedness and bullying involvement with multiple screen-time behaviours among youth in two Canadian provinces: a COMPASS study

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Abstract

Introduction: Screen time, a proxy for sedentary behaviours, has emerged as a critical health determinant among youth in contemporary societies, where most aspects of youth life involve access to screen-time devices. An understudied approach to reducing screen time among youth is bullying reduction. This study aims to understand the association between bullying perpetration, victimization, youth perception of the school environment and multiple screen-time behaviours.

Methods: A total of 44,861 youth aged between 13 and 18 years in two Canadian provinces completed a validated questionnaire that collected student data on health behaviours and outcomes, including multiple screen-time behaviours, bullying perpetration and victimization, and school connectedness. The outcome variables were total screen time, time spent watching television, playing video games, internet surfing, and communication-based screen-time behaviours. Using a random intercept, the final models were built using PROC MIXED in SAS 9.4. These models were adjusted for age, ethnicity, weekly disposable income, daylight hours, and weather variables.

Results: Compared to youth who reported non-involvement in bullying, youth who were bullies, victims, or both bullies and victims spent on average more minutes per day in front of screens across all screen time categories. Youth who felt happy and safe at school, and who perceived their teachers as being fair, reported lower levels of multiple screen-time behaviours.

Conclusion: With non-involvement in bullying showing a strong negative association with multiple screen-time behaviours, school policies to address bullying and screen time through school connectedness could offer a novel approach in minimizing these harmful behaviours.

Keywords: youth health, school connectedness, bullying, screen time, TV, internet surfing, texting, video games

Highlights

- Bullying perpetration, victimization, or both are associated with increased multiple screen-time behaviours among youth.
- Non-involvement in bullying is associated with decreased multiple screen-time behaviours among youth.
- Positive perception of the school environment and enhanced school connectedness could play an important role in minimizing screen time among youth.
- Strategies to minimize screen time among youth should move beyond limiting access to screen-time devices.
- School policies should target both bullying and screen time to maximize the reduction of these complex harmful behaviours.

Introduction

Screen time (ST), a proxy for sedentary behaviours, has emerged as a critical determinant of health among youth in contemporary societies,[1,2] where most aspects of youth life involve digital media.[3,4] ST is associated with a wide range of poor health outcomes, including obesity, metabolic syndrome, anxiety and depression, poor vision, and multiple risk behaviours such as smoking and other illicit drug use.[5-9]

Evidence also suggests that time spent using computers and playing video games is associated with physical violence,[10] as well as increased loneliness, risk of online victimization,[11] and various functional problems such as peer-related issues and

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hyperactivity.[12,13] An important yet understudied avenue for reducing ST in youth may involve targeting negative social factors in their environment, such as bullying.

Bullying is a heterogeneous concept that refers to a wide array of repeated behaviours, including physical and verbal aggressions, intended to harm or intimidate individuals who are perceived as less powerful.[14] Bullying affects between 6 and 40 per cent of youth annually (youth sample consisted of ages 11, 13, and 15 years)[15,16] and has been linked to various poor health outcomes, such as depression, suicidal ideation, and physical inactivity.[17-19] Cyber-bullying is a special cause for concern as it is not confined to social settings and can occur anytime and anywhere through electronic devices. Online communication is also faster, more widespread, and sometimes anonymous with limited accountability, which can create disinhibition and distance from the victim that may prompt more severe aggressions[20] and lead to worse outcomes compared to other types of bullying (e.g., suicide attempts that need medical attention, heavier substance use).[21,22]

Drawing upon existing literature on bullying interventions, school strategies such as environmental supervision (e.g., playground supervision) and educating school staff about appropriate strategies for intervening are somewhat effective in reducing aggressions and victimization among youth.[15,20] The effectiveness of anti-bullying endeavours may, however, be contingent upon students' perceptions of school connectedness and environment. Rates of bullying are lower when students perceive their school environment as supportive and safe, the school climate is positive (e.g., staff/teachers provide caring atmosphere that promotes autonomy), and when students have positive relationships with teachers.[23,24]

This study is based on the hypothesis that involvement in bullying (either perpetration, victimization, or both) and negative perceptions of the school environment and school connectedness are associated with increased ST in youth. The study aims to understand the association between bullying perpetration, victimization, and youth perception of the school environment and school connectedness on different types of ST behaviours after controlling for weather variation (a perennial factor that is known to influence sedentary behaviours) in two geographically and climatically distinct provinces in Canada (Ontario and Alberta).[25-27]

Methods

Design

COMPASS (2012-2021) is a cohort study collecting data from a focussed sample of secondary school students (grades 9 through 12) and the schools they attend in Ontario (n = 79) and Alberta (n = 10).[28] This study uses secondary cross-sectional student- and school-level data from Year 2 (2013-2014) of the COMPASS cohort. Year 2 data were used because Year 1 data consisted of a smaller sample of schools (www.compass.uwaterloo.ca).[28]

Participants

Parents or guardians of eligible students were mailed an information letter or received an automated call about the COMPASS study and were asked to contact the COMPASS recruitment coordinator using a toll-free phone number or email address if they did not want their child to participate. Students whose parents or guardians did not contact the COMPASS team to withdraw their child were deemed eligible to participate. Students could also withdraw themselves and decline participation at any time. All procedures were approved by the University of Waterloo Office of Research Ethics and participating School Boards. In Ontario, out of a total 52,529 students enrolled in grades 9 to 12, 80.1% (N = 41 734) students completed the student-level COMPASS questionnaire (Cq)[28]; in Alberta, out of a total of 4,700 students enrolled in grades 9 to 12, 77.1% (N = 3564) of students completed the Cq in class time on the day of their schools' scheduled data collection.

Data collection tools

The Cq collects individual student data pertaining to demographic variables (e.g., age, ethnicity, disposable income) and health behaviours, including physical activity, ST-based sedentary behaviour, bullying, and school connectedness. Items measured on the Cq were based on national standards or current national public health guidelines.[28] To account for weather variation, weather and daylight data were obtained for each COMPASS school through the Environment Canada website's Climate database.[29]

Policies and programs related to physical activity and bullying were measured using the School Policies and Practices Questionnaire, a paper-based survey completed by the administrator most knowledgeable about the school's program, practice, and policy environment. This survey measured the presence or absence of relevant programs and policies, as well as changes to school programs, policies, or resources, that are related to student health.

Measures

Student-level measures

Students were asked to report, via four individual items on the Cq, the average amount of time per day they had spent in each type of ST behaviour for the past 7 days: (1) watching/streaming TV shows or movies; (2) playing video/computer games; (3) surfing the internet; and (4) texting, messaging, and emailing. Total ST was measured as the sum of minutes for these four activities. Reported ST was not context-specific (e.g., school, home). Previous research found that the test re-test reliability for these individual items ranged from fair (TV: ICC = 0.56) to moderate (playing video or computer games: ICC = 0.65; surfing the internet: ICC = 0.71) to substantial (texting, messaging, emailing: ICC = 0.86).[30,31]

Students reported their experience related to bullying by answering the following question: "In the last 30 days, in what ways were you bullied by other students?" with response options of "I did not get bullied by other students"; physical attacks, verbal attacks, or cyber-attacks; and stealing. They were also asked: "In the last 30 days, in what ways did you bully other students?" with response options of "I did not bully other students"; physical attacks, verbal attacks, or cyber-attacks; and stealing. Perception of school environment and school connectedness was measured by asking students to strongly agree, agree, disagree, or strongly disagree with the following statements: "I feel close to people at my school," "I feel I am a part of my school," "I am happy to be at my school," "I feel the teachers at my school treat me fairly," "I feel safe in my school," and "getting good grades is important to me."

School-level measures

School level variables of interest for this study included policies to address bullying and enhance physical activity. Bullying policy questions for school administrators included examples such as, "Is bullying a problem in your school?" (Yes/No); "Does your school have any policies to address bullying?" (Yes/No. If yes, "Please list them" (Table 1).

Weather and daylight data

All weather data were for the seven days prior to the Cq data collection date to match ST recall data. Data on maximum temperature (degrees Celsius [°C]), total rainfall (millimetres [mm]), and total daylight hours (sunrise to sunset) were collected.

Analyses

All the analyses were carried out in SAS 9.4. The sample was divided into four groups (Ontario males and females, Alberta males and females) to develop five random-intercept linear regression models for each of the five outcomes. Random-intercept models were chosen because they account for the effects of clustering of children within each school. The primary assumption of these models is that the mean outcome for each school varies around a grand mean of the outcome for all schools. The estimated coefficients in the models are indicative of the amount of increase in the ST minutes associated with one-unit increase in the independent variables, holding other covariates fixed. The five outcomes were average minutes/day of total ST, and individual ST behaviours (television viewing, internet surfing, video gaming, communication-based ST). The models were adjusted for age, ethnicity, weekly disposable income, daylight hours, and weather variables.

Results

As shown in Table 2 total ST (min/day) was similar among females (Ontario: mean = 473.7 ± 318.7; Alberta: 459.9 ± 325.0) and males (Ontario: mean = 481.5 ± 332; Alberta: 476.9 ± 340.5) in both provinces, with a major proportion of youth (41%) accumulating more than 7.5 hours of ST per day. Males in both Ontario and Alberta spent significantly more minutes per day playing video games than females (< 0.0001), whereas females spent significantly more minutes per day in communication-based ST behaviours and internet surfing (< 0.0001) (Table 2). Time spent watching TV was similar between females and males in both provinces.

The prevalence of reported bullying victimization and perpetration was similar across the two provinces. In both provinces, the proportion of females who reported being bullied in the past 30 days was significantly higher than males (< 0.0001) (Table 2). In contrast, in both provinces, the proportion of males who reported bullying others in the past 30 days was significantly higher than females (< 0.0001) (Table 2). In both provinces, males reported being victims of significantly more physical attacks (< 0.0001) and females reported being victims of significantly more verbal and cyber-attacks (< 0.0001). Figures 1 and 2 show that in both Ontario and Alberta, youth who reported involvement in bullying, both as perpetrators and victims, also reported significantly higher ST in comparison with youth who reported being only perpetrators or only victims and youth who reported non-involvement (< 0.0001).

Separate random-intercept linear effects models for males in Ontario, females in Ontario, and total youth (males and females) in Alberta examined the associations between youth perception of the school environment, school connectedness, and bullying involvement (perpetration, victimization) and non-involvement (i.e., those who were neither bullied nor bully others) with multiple ST behaviours (Tables 3, 4, 5 and 6). Overall, higher perceived school connectedness was associated with lower ST across all groups (i.e., Ontario males, Ontario females, and total youth in Alberta). On the other hand, involvement in bullying, whether perpetration, victimization, or both, was associated with higher ST across all groups.

Ontario males

Among males in Ontario, feeling happy and safe at school and perceiving teachers as fair was associated with significantly lower total ST. Males who felt safe at school reported lower TV viewing time and males who felt like they were part of their school reported less time playing video games and surfing the Internet.

TABLE 1
Description of school-level bullying policies and within-province, between-school differences in total screen time/day based on presence or absence of policies/programs

School-level questions	School-level outcomes (Yes/No)	Total daily screen time in minutes					
		Alberta		*p*-value	Ontario		*p*-value
		Yes	No		Yes	No	
Does your school have written policies on the following? e.g., bullying	Alberta (yes=2, no=7) Ontario (yes=3, no=73)	440.2	477.3	0.0023	489.7	475.3	0.1615
In which fields does your school receive support from your school's local Public Health Unit? (Check all that apply) e.g., bullying	Alberta (yes=1, blank=9), Ontario (yes =27, blank=52)	535.2	461.4	0.0009	476.5	478.4	0.5492
Is bullying a problem at your school?	Alberta (yes=8, no=2), Ontario (yes=45, no=30)	477.0	441.9	0.0050	475.4	478.9	0.3060
Does your school have any programs that address bullying?	Alberta (yes=7, no=3) Ontario (yes=74, no=5)	481.4	443.6	0.0014	477.3	482.3	0.4618

Notes: *p*-values are based on ANOVA and show the differences between within province total screen time behaviours/day based on the presence or absence of policies/programs (yes/no).

Only variables that were statistically significant following backward stepwise elimination were included in the models.

TABLE 2
Demographic and screen time characteristics for students participating in Y2 of the COMPASS study in Ontario and Alberta, Canada, 2013-2014

Descriptive category	ON (N = 41 324)				AB (N = 3537)			
	Female (n = 20 388)	Male (n = 20 936)	DF	*p*-value	Female (n = 1761)	Male (n = 1776)	DF	*p*-value
Grade (%; n)								
9	26.7 (5445)	27.5 (5742)	3	0.027	15.0 (264)	15.4 (274)	3	0.6978
10	26.2 (5344)	25.3 (5277)			33.0 (582)	31.3 (556)		
11	24.9 (5062)	24.4 (5099)			28.3 (499)	28.5 (505)		
12	22.2 (4511)	22.9 (4777)			23.6 (416)	24.8 (440)		
Age (%; n)								
13	1.1 (229)	1.2 (250)	5	< .0001	0.4 (7)	0.6 (10)	5	0.0214
14	21.6 (4405)	21.6 (4517)			13.0 (229)	11.5 (204)		
15	25.9 (5284)	24.8 (5176)			29.4 (517)	26.8 (475)		
16	25.3 (5155)	24.5 (5129)			30.2 (531)	29.4 (522)		
17	20.2 (4119)	20.6 (4307)			22.2 (391)	24.8 (440)		
18	5.8 (1179)	7.3 (1528)			4.9 (86)	6.9 (123)		
Ethnicity (%; n)								
White	75.3 (15342)	73.2 (15315)	5	< .0001	74.2 (1307)	72.6 (1290)	5	0.0067
Black	3.2 (657)	4.9 (1033)			1.2 (21)	2.8 (50)		
Asian	5.2 (1068)	5.2 (1082)			3.4 (60)	4.4 (78)		
Aboriginal	3.0 (613)	2.8 (591)			11.1 (195)	10.2 (182)		
Hispanic	1.9 (386)	2.2 (453)			0.5 (8)	0.2 (4)		
Other/Mixed	11.4 (2322)	11.8 (2462)			9.7 (170)	9.7 (172)		
BMI categories (%; n)								
Underweight	1.4 (282)	1.7 (350)	4	< .0001	1.4 (25)	1.8 (32)	4	< .0001
Healthy weight	61.7 (12574)	52.6 (11021)			58.0 (1022)	50.0 (888)		
Overweight	11.4 (2332)	16.7 (3493)			11.8 (208)	16.9 (300)		
Obese	4.1 (838)	8.3 (1734)			6.0 (105)	10.1 (180)		
Not Stated	21.4 (4362)	20.7 (4338)			22.8 (401)	21.2 (376)		
Weekly disposable income (%; n)								
Zero	15.3 (3127)	16.8 (3513)	7	< .0001	13.9 (245)	14.3 (254)		< .0001
$1 to $5	7.0 (1428)	6.4 (1331)			3.8 (67)	3.4 (61)		
$6 to $10	8.1 (1650)	7.9 (1658)			6.0 (105)	4.1 (72)		
$11 to $20	14.8 (3016)	14.8 (3105)			10.3 (181)	9.6 (170)		
$21 to $40	13.1 (2676)	12.3 (2584)			12.6 (222)	12.4 (221)		
$41 to $100	14.9 (3037)	12.4 (2600)			17.2 (303)	15.0 (266)		
More than $100	13.7 (2787)	17.2 (3591)			17.5 (309)	27.7 (492)		
DK/Missing	13.1 (2667)	12.2 (2554)			18.7 (329)	13.5 (240)		
Bullying victimization and perpetration (%; n)								
Victims of bullying	23.9 (4867)	19.7 (4120)			30.8 (542)	22.1 (392)		
Victims of physical attacks	1.8 (358)	3.7 (775)	1	< .0001	2.6 (46)	5.3 (95)	1	< .0001
Victims of verbal attacks	17.5 (3562)	11.8 (2463)	1	< .0001	24.9 (438)	13.6 (241)	1	< .0001
Victims of cyber-attacks	8.2 (1671)	2.9 (600)	1	< .0001	10.2 (179)	2.9 (52)	1	< .0001

Continued on the following page

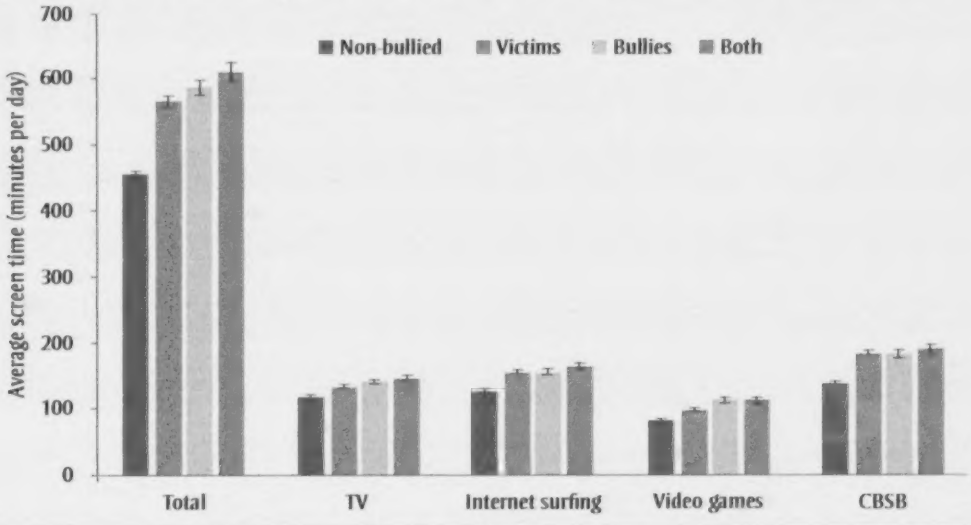
TABLE 2 (continued)
Demographic and screen time characteristics for students participating in Y2 of the COMPASS study in Ontario and Alberta, Canada, 2013-2014

Descriptive category	ON (N = 41 324)				AB (N = 3537)			
	Female (n = 20 388)	Male (n = 20 936)	DF	*p*-value	Female (n = 1761)	Male (n = 1776)	DF	*p*-value
Bullying victimization and perpetration (%; n) (continued)								
Victims of property damage and theft	2.6 (526)	3.4 (702)	1	< .0001	3.6 (63)	4.3 (77)	1	0.2476
Perpetrators of bullying	10.3 (2102)	15.9 (3338)			11.9 (209)	18.0 (319)		
Perpetrators of physical attacks	0.9 (187)	3.3 (681)	1	< .0001	0.4 (7)	4.7 (83)	1	< .0001
Perpetrators of verbal attacks	6.6 (1353)	9.5 (1984)	1	< .0001	9.3 (163)	11.7 (208)	1	0.0172
Perpetrators of cyber-attacks	2.1 (438)	1.8 (370)	1	0.0052	1.3 (23)	2.0 (36)	1	0.0941
Perpetrators of theft and property damage	0.6 (118)	1.6 (328)	1	< .0001	0.3 (6)	1.7 (31)	1	< .0001
Non-involvement in bullying (%; n)								
Did not bully others	89.7 (18286)	84.1 (17598)	1	< .0001	88.1 (1552)	82.0 (1457)	1	< .0001
Did not get bullied	76.1 (15521)	80.3 (16816)	1	< .0001	69.2 (1219)	77.9 (1384)	1	< .0001
Multiple screen-time behaviours (mean minutes/day; SD)								
Total screen time	473.7 (318.7)	481.5 (332.0)		0.0153	459.9 (325.0)	476.9 (340.5)		0.1295
TV	122.6 (92.1)	120.4 (96.0)		0.0147	115.3 (89.1)	119.4 (98.1)		0.1945
Internet surfing	143.0 (129.7)	117.3 (120.7)		< .0001	128.6 (133.8)	104.8 (118.5)		< .0001
Video games	38.4 (81.4)	126.0 (128.4)		< .0001	43.7 (83.8)	125.4 (127.0)		< .0001
Communication-based screen-time behaviours	169.7 (165.3)	117.9 (145.3)		< .0001	172.2 (169.2)	127.2 (154.7)		< .0001

Abbreviations: BMI, body mass index; DF, degrees of freedom; SD, standard deviation.

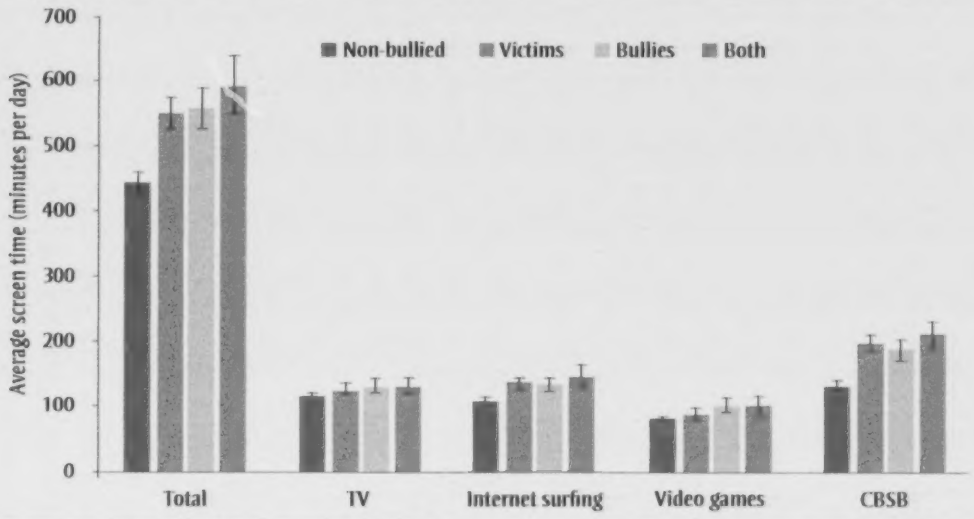
Note: Only variables that were statistically significant following backward stepwise elimination were included in the models.

FIGURE 1
Average screen-time behaviours across the distribution of bullying perpetration, victimization, both perpetration/victimization, and non-involvement in Ontario, Canada, COMPASS Study (2013-2014)



Abbreviation: CBSB, communication-based screen-time behaviours.

FIGURE 2
Average screen-time behaviours per day across the distribution of bullying perpetration, victimization, both perpetration/victimization, and non-involvement in bullying in Alberta, Canada, COMPASS Study (2013-2014)



Abbreviation: CBSB, communication-based screen-time behaviours.

However, males who reported being close to people in their school spent more time in communication-based ST behaviours and accumulated more total ST.

Males who reported being attacked physically had significantly more TV viewing time and accumulated more total ST. Males who bullied others on the Internet and those who were responsible for damaging property or theft spent more time playing video games. Males who reported that they had engaged in verbal attacks against others spent significantly less time in communication-based ST behaviours. Males who were not bullied in any form reported significantly less time playing video games.

Ontario females

Among females in Ontario, feeling happy and safe at schools and perceiving teachers as fair was associated with significantly lower total ST. Females in Ontario who felt safe and part of their school reported lower TV viewing time. Females who reported being happy and safe at school reported less time surfing the internet. Feeling happy and safe at school and perceiving teachers as fair was further associated with fewer minutes per day spent in communication-based ST behaviours. Moreover, similar to the findings among males, feeling close to people at school was associated with significantly more communication-based ST behaviours and more total ST among females.

Females who reported cyber-attacks spent more time surfing the internet and in communication-based ST behaviours. Females who reported bullying others online also had significantly more communication-based ST behaviours. On the other hand, females who reported non-involvement in bullying (i.e., those who did not bully or get bullied) reported significantly lower ST. Females who reported that they did not bully spent less time surfing the internet, in communication-based ST behaviours, and accumulated lower total ST. Females who reported not being victims of bullying reported less time spent in communication-based ST behaviours and accumulated lower total ST.

Alberta youth

Females in Alberta who felt being part of their school reported significantly less time playing video games. Both females and males who reported cyber-attacks spent more time in communication-based ST behaviours, with females who reported cyber-attacks also accumulating more total ST. Females and males who reported that they had not bullied others spent significantly less time in communication-based ST behaviours. Females and males who were not bullied spent significantly less time surfing the Internet and accumulated lower total ST, with females who were not bullied also spending less time in communication-based ST behaviours

Discussion

The purpose of this study was to examine the association between perception of school environment, school connectedness, and involvement in bullying with multiple ST behaviours among youth in a large sample spread across two Canadian provinces. Our hypothesis that involvement in bullying and negative perceptions of school environment and school connectedness are associated with higher ST was supported.

Average ST reported among youth in both provinces was more than 7.5 hours per day, which corroborates a nationally representative sample of youth in Canada.[32] The high ST accumulation among youth is attributed to constant access and exposure to diverse ST devices, both at school and at home.[33] Thus, it is essential that studies capture the entire range of ST behaviours. Males spent significantly more time playing video games than females, whereas females spent significantly more time in communication-based ST behaviours and surfing the internet. These findings highlight the need for gendered interventions in reducing ST among youth.[33]

TABLE 3

Random-intercept linear regression model showing the relationship between perception of school environment and school connectedness, and involvement in bullying with multiple and total screen-time behaviours among boys in Ontario, Canada, COMPASS Study (2013-2014)

	Ontario males									
	TV		Video games		Internet surfing		Communication-based screen time		Total screen time	
	Est.	95% CI	Est.	95% CI	Est.	95% CI	Est.	95% CI	Est.	95% CI
School connectedness										
Close to people							0.19	0.14 to 0.23	0.05	0.01 to 0.09
Part of school			−0.10	−0.13 to −0.06	−0.08	0.02 to −0.12				
Happy at school							−0.08	−0.13 to −0.04	−0.06	−0.10 to −0.02
Fair teachers							−0.19	−0.24 to −0.15	−0.10	−0.14 to −0.06
Safe at school	−0.06	−0.09 to −0.03							−0.07	−0.12 to −0.02
Victims of bullying										
Physical attacks	0.25	0.14 to 0.35							0.33	0.19 to 0.48
Verbal attacks										
Cyber-attacks					0.45	0.31 to 0.60	0.61	0.45 to 0.78	0.45	0.29 to 0.61
Bullying perpetrators										
Verbal attacks							−0.24	−0.41 to −0.06		
Cyber-attacks			0.25	0.03 to 0.46						
Property damage			0.18	−0.07 to 0.43						
Non-involvement in bullying										
Did not get bullied			−0.14	−0.20 to −0.08						
Did not bully										

Abbreviations: CI, confidence interval; Est., estimate.

Note: Only variables that were statistically significant following backward stepwise elimination were included in the models.

Females in Ontario who felt like they were part of their school spent less time on average watching TV. Previous research suggests that time spent watching TV is associated with loneliness and lower social engagement.[34,35] Youth who report feeling integrated in their school may be more likely to be actively involved in school activities and thus have higher social engagement and lower TV time.

However, feeling close to people at school was associated with more communication-based ST behaviours, and higher total ST among both males and females in Ontario. These findings are in line with previous research that shows that communication-based ST behaviours (e.g., short messaging services, instant messages) have become the primary and preferred method of interpersonal communication among youth and are associated with efforts to enhance belonging.[36,37] This increase in communication-based ST behaviours could explain higher total ST among youth who feel closer to people at school. There appear to be obvious trade-offs in terms of various aspects of school connectedness and their relationship with different ST behaviours. Nevertheless, our models showed that both Ontario males and females who felt happy and safe at school and who perceived their teachers as being fair reported lower levels of multiple ST behaviours. This reiterates the point that a positive perception of the school environment and enhanced school connectedness could play an important role in minimizing ST among youth.

Bullying perpetration and victimization were both associated with increased ST among youth. Compared to youth who reported non-involvement in bullying, youth who were bullies, victims, and both bullies and victims spent on average more minutes per day in front of screens across all ST categories.

Prevalence of past-month involvement in bullying was approximately 20% among both females and males in Alberta and Ontario, which is similar to previously reported prevalence rates of bullying involvement in Canada.[38] Involvement in bullying differed between males and females by type of bullying behaviours. More males reported being victims and perpetrators of physical violence, perpetrators of verbal attacks, and perpetrators of property damage or theft. More females reported being victims of verbal attacks,

TABLE 4

Random-intercept linear regression model showing the relationship between perception of school environment and school connectedness, and involvement in bullying with multiple and total screen-time behaviours among girls in Ontario, Canada, COMPASS Study (2013-2014)

	Ontario females									
	TV		Video games		Internet surfing		Communication-based screen time		Total screen time	
	Est.	95% CI	Est.	95% CI	Est.	95% CI	Est.	95% CI	Est.	95% CI
School connectedness										
Close to people							0.12	0.08 to 0.16	0.06	0.03 to 0.10
Part of school	−0.06	−0.09 to −0.03								
Happy at school					−0.12	−0.16 to −0.09	−0.08	−0.13 to −0.04	−0.13	−0.17 to −0.09
Fair teachers							−0.19	−0.24 to −0.14	−0.13	−0.17 to −0.09
Safe at school	−0.07	−0.10 to −0.03			−0.09	−0.14 to −0.05	−0.12	−0.17 to −0.06	−0.14	−0.19 to −0.09
Victims of bullying										
Cyber-attacks					0.21	0.12 to 0.29	0.49	0.37 to 0.61		
Bullying perpetrators										
Cyber-attacks							0.39	0.19 to 0.60		
Non-involvement in bullying										
Did not get bullied							−0.19	−0.27 to −0.11	−0.17	−0.25 to −0.10
Did not bully					−0.20	−0.28 to −0.13	−0.21	−0.31 to −0.10	−0.30	−0.39 to −0.21

Abbreviations: CI, confidence interval; Est., estimate.

Note: Only variables that were statistically significant following backward stepwise elimination were included in the models.

and both victims and perpetrators of cyber-bullying. This evidence reiterates existing literature that suggests that males are more likely to engage in physical aggressions, whereas females tend to engage in bullying perpetration through social aggression.[38]

One consistent pattern was that the victims of cyber-attacks were associated with more communication-based ST in all four cohorts. However, cyber-bullying perpetrators among Ontario females also had higher communication-based ST, which could potentially be explained by the evidence that females predominantly engage in bullying perpetration through social manipulation.[39]

Females in both Ontario and Alberta spent significantly more time than males surfing the internet and in communication-based

TABLE 5

Random-intercept linear regression model showing the relationship between perception of school environment and school connectedness, and involvement in bullying with multiple and total screen-time behaviours among boys in Alberta, Canada, COMPASS Study (2013-2014)

	Alberta males									
	TV		Video games		Internet surfing		Communication-based screen time		Total screen time	
	Est.	95% CI	Est.	95% CI	Est.	95% CI	Est.	95% CI	Est.	95% CI
Victims of bullying										
Cyber-attacks							1.35	0.76 to 1.94		
Non-involvement in bullying										
Did not get bullied					−0.37	−0.56 to −0.17			−0.25	−0.48 to −0.02
Did not bully							−0.48	−0.75 to −0.21		

Abbreviations: CI, confidence interval; Est., estimate.

Note: Only variables that were statistically significant following backward stepwise elimination were included in the models.

TABLE 6
Random-intercept linear regression model showing the relationship between perception of school environment and school connectedness, and involvement in bullying with multiple and total screen-time behaviours among girls in Alberta, Canada, COMPASS Study (2013-2014)

	Alberta females									
	TV		Video games		Internet surfing		Communication-based screen time		Total screen time	
	Est.	95% CI	Est.	95% CI	Est.	95% CI	Est.	95% CI	Est.	95% CI
School connectedness										
Part of school			−0.24	−0.37 to −0.10						
Victims of bullying										
Cyber-attacks							0.38	0.05 to 0.72	0.52	0.19 to 0.84
Non-involvement in bullying										
Did not get bullied					−0.17	−0.34 to −0.00	−0.45	−0.69 to −0.21	−0.28	−0.50 to −0.07
Did not bully							−0.32	−0.60 to −0.03		

Abbreviations: CI, confidence interval; Est., estimate.

Note: Only variables that were statistically significant following backward stepwise elimination were included in the models.

ST behaviour. Previous studies have also found that risk of cyber-bullying victimization is higher with more time spent on the internet, including more "chatting online."[10,11] Cyber-bullying is different from other types of bullying in that it can occur anytime and anywhere through multiple digital devices. In addition, youth that engage in cyber-bullying perpetration are more likely to be involved in school bullying, either as a perpetrator or a victim.[11]

Bullying perpetration through property damage and theft was associated with more time spent playing video games for males in Ontario. These findings are in line with Janssen et al.'s[10] prospective cohort study that found that video game use predicted physical violence among high school students.

Perhaps the most conclusive evidence of the strong association between bullying perpetration/victimization and ST behaviours is shown by the findings that among all four cohorts, non-involvement in bullying (i.e., youth who were not bullied or who did not bully) was associated with lower accumulation of multiple ST behaviours. ST behaviours are complex not only because they are enabled by a constant access to a range of multiple digital media devices (e.g., TV, desktop/laptop computers, tablets), but also because of the varied impact of each ST behaviour. For instance, both TV viewing and playing video games are associated with increased loneliness and poor social engagement,[13,37,43] with video games also being connected to physical violence[10] and TV viewing to poor nutritional choices associated with obesity.[40,41]

Communication-based ST behaviours are more complicated because although they correlate with social engagement and connections,[36] they are also associated with cyber-bullying.[10,11] Furthermore, there is gendered variation in ST behaviours, with males spending significantly more time playing video games and females spending significantly more time accumulating communication-based ST behaviours.

With consistently increasing dependence on the use of multiple ST devices among youth,[37] restricting access to ST devices is becoming exceedingly difficult. Different types of ST behaviours can be accumulated via access to various devices. For example, youth can watch TV, play video games, surf the internet, and communicate via texts, online messaging, or emails using laptops, desktops, tablets, and even smartphones – sometimes simultaneously. In this scenario, strategies to minimize ST should move beyond limiting access to ST devices.

It is theoretically difficult to argue a linear, unidirectional relationship between multiple ST behaviours and bullying, especially with evidence from a cross-sectional study. ST and bullying are complex behaviours that need to be studied with more robust study designs, and a systems science perspective to delineate if their relationship is causal or more complex.[42-44] Nevertheless, the evidence of an association between bullying, school connectedness, and ST, has policy implications for schools to address bullying perpetration and the prevalence of multiple screen-time behaviours.

With non-involvement in bullying showing a strong negative association with multiple ST behaviours, school policies to address both bullying and screen time could offer a novel approach in reducing harmful behaviours among youth. However, school policies should focus on improving youth perception of school environment and connectedness as this could enable pathways to prevent bullying and reduce ST.

Strengths and limitations

The major strength of the study is the sample size of schools and distribution of participants across two Canadian provinces who reported multiple ST behaviours. However, the modeling of multiple ST behaviours and the depiction as well as the interpretation of results can be challenging due to the large number of independent factors that need to be tested across different ST behaviours. Potential under reporting, recall bias, and missing data are the primary limitations of the

study due to its reliance on self-reported surveys. Nevertheless, COMPASS survey measures specific to this study have previously demonstrated satisfactory reliability and validity.[29] Another limitation is the lack of context in terms of ST behaviours because we do not know the type of digital devices that youth were using to accumulate different types of ST behaviours and where they are using these devices (e.g., home, school). It is important to understand the nuances and distribution of ST behaviours across different devices and physical contexts to tailor ST reduction policy interventions.

Adapted ST surveys that capture the variation of ST behaviours accumulated over different types of screens or devices and ecological momentary assessments deployed through smartphones could provide the device and physical context lacking in current evidence.[45] Smartphone-based studies could also reduce recall bias and measure objective smartphone ST behaviour.[46] Finally, since this study is cross-sectional in nature, causal inferences cannot be made and there may be pathways through which more ST could result in greater exposure to bullying, especially when it comes to the association of computer usage and video games with physical violence[10] and the risk of online victimization.[11]

Conclusion

This study is the first to simultaneously examine the association between involvement in bullying, youth perception of school environment/school connectedness, and multiple ST behaviours. Our findings suggest that school policies should focus on improving school connectedness and target both bullying and screen time to maximize the reduction of these complex harmful behaviours.

Acknowledgments

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Conflicts of interest

Apart from Dr. Leatherdale being the CIHR-PHAC Chair in Applied Public Health Research, and an Associate Scientific Editor with *Health Promotion and Chronic Disease Prevention in Canada: Research, Policy and Practice*, we declare that no other conflicts of interest exist.

Authors' contributions and statement

TRK conceptualized the study, interpreted the data and drafted the paper. AST and RL interpreted the data and drafted the paper. WQ analyzed the data and drafted the paper. STL designed the study, and acquired and interpreted the data. All authors revised the paper and approved its final version.

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At-a-glance

Bringing equity into the fold: a review of interventions to improve mental health

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Abstract

In Canada, it is challenging to find examples of positive population mental health interventions that meet scientific standards of evidence. It is even more difficult to identify effective interventions that address health equity. The discrepancy between standards of evidence in the health sciences, and the evidence that can be gleaned from social experiments, is not new. Efforts to reconcile these differences show a general tendency toward controlled interventions in public health. However, it is possible to extract findings from quasi-experimental interventions that meet scientific standards while also showing promise of positive impacts on mental health equity. This article describes work undertaken in 2015 to begin to address this evidence gap.

Keywords: equity-focused, mental health, quality of evidence, external validity, intervention design, evidence for equity

Highlights

- The majority of equity-focused interventions identified in this review did not use validated methods to evaluate effectiveness.
- There appears to be a trade-off between social innovation to advance mental health equity and the quality of evidence produced.
- Consequently, many examples of culturally- and contextually-relevant mental health interventions that aim to address equity continue to go unreported or undetected.
- The authors propose three ways to rectify these evidence gaps.

Introduction

While many Canadians experience positive mental health, important inequities persist and, in some areas, are increasing.[1] Evidence shows that some population groups are at a higher risk of poor mental health due to social, material and economic circumstances; such as experiences of everyday discrimination or food insecurity.[2] Indigenous youth, sexual and gender minority youth are among those who experience rates of high mental distress.[3,4] By targeting life conditions that can be harmful to mental health, it is possible to improve wellbeing for everyone, while benefiting the most vulnerable. This can be seen in the housing sector where investments to provide secure permanent shelter to low-income individuals can be life-changing for homeless youth, who suffer high rates of poor mental health.[5]

Health equity in our context is defined as "the absence of avoidable or modifiable differences in health among populations or groups defined socially, economically, or geographically. These measurable health differences arise from underlying levels of social advantage/disadvantage, show a consistent pattern across the population, and are considered to be unfair."[6]

Poor mental health can affect any individual or family. However, the path to recovery is, in part, influenced by the life course; from early childhood through to the elder years.[7] Exposure to trauma can lead to different outcomes, depending on an individual's life skills and social supports. These conditions shape one's ability to cope with life's stressful events.[8]

According to the Canadian chronic disease surveillance statistics, more than one in ten individuals are affected by a mood or anxiety disorder in Canada, representing nearly three-quarters of the population that uses health services for a mental illness annually.[9] Of the 4000 deaths by suicide each year in Canada, more than 90 percent of individuals were experiencing a mental illness or mental health problem.[10] Suicide is the second leading cause of death in children, youth and young adults aged 10-29 years.[10] Boys account for 65% of suicides among 15-19 year olds, while girls account for over 80% of self-harm hospitalizations in that same age group.[11,12] Perhaps less known, girls aged 10-14 years account for 59% of suicides in that age cohort.[11] These statistics reveal significant gender differences in levels of vulnerability as girls, boys and gender-diverse children transition to adolescence and early adulthood, reinforcing the need to apply sex- and gender-based analysis (SGBA) to mental health promotion / mental illness prevention initiatives.[9,13] Moreover, existing research into transgender populations shows a worrisome relationship between individual life circumstances and risk of suicide and other self-harming behaviour.[4] It is, therefore, time that we contextualized poor mental health by implementing policies, programs and interventions that

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can reduce or remove systemic and structural barriers to mental health equity.

Methods

As part of its efforts to promote evidence-informed decision making, the Public Health Agency of Canada (PHAC) launched the Canadian Best Practices Portal (the Portal) in 2008, a searchable database of population health interventions that have been assessed as meeting specific criteria for either "promising practices" or "best practices," or "Aboriginal Ways Tried and True (WTT)."

This article describes work undertaken in 2015 to identify mental health interventions on the Portal that were equity-focused in both design and impact, building on earlier efforts that focused on healthy weights.[14]

All mental health interventions that met the equity criteria were also rated using the detailed assessment tool developed for the Portal.[14] This rating tool assesses interventions within three broad domains: impact, adaptability and quality of evidence. Only those mental health interventions that scored as a 'promising practice' or 'best practice' on the rating scale, or met the criteria for Aboriginal Ways Tried and True, qualified for inclusion in our review. Most interventions were excluded because they did not meet the minimum score for quality of evidence.

In addition, specific criteria were used in order for interventions to be designated as equity-focussed. Interventions were required to: 1) report positive outcomes specifically for people living in conditions of disadvantage (these outcomes may or may not be compared to people living in more advantaged conditions); and *either* 2) explicitly target people living in conditions of disadvantage *or* 3) include activities that are focussed on specific health equity goals (e.g., that address the disproportionate exposure to health-damaging factors).[14]

Results

The review began with the 113 mental health interventions originally posted on the Portal. Of these, only 11 met the health equity criteria (after satisfying the new best practice or promising practice criteria). An external search saw eight additional interventions pass basic screening criteria for mental health promotion. However, of these, only two met the criteria for health equity focus, resulting in a combined total of 13 interventions. A sample of 5 interventions that met the minimum evidence standards, as well as health equity criteria, is presented in Table 1.

Mental health interventions that qualified for inclusion often aimed at individual or family-level behaviour change. A few targeted school culture, an area that has grown exponentially yet produced few rigorous studies. One exception, a housing intervention (Housing, Insulation and Health Study), produced evidence of positive impacts on overall wellbeing, by targeting changes to the physical environment (Table 1). The same study found that better insulated homes produced significant improvements to social and emotional functioning, in addition to higher scores for physical health, compared to the control group. People in the intervention group also saw a significant improvement in measures of vitality, happiness and general health scores compared with the control group. Such examples offer much-needed evidence of how changes to the physical environment (investing mid- to upstream) can produce positive and lasting mental health impacts. We might not have anticipated the psychosocial benefits to improving indoor housing quality. However, this finding should not be overlooked given the potential to impact mental health for Canadians living in substandard housing, many of whom face multiple systemic barriers to experiencing positive mental health.

These five examples may also serve to illustrate another important finding. Studies that aim to address equity as a primary objective tend to focus downstream, by aiming to improve the coping skills and social supports of vulnerable individuals. There would appear to be a trade-off between the equity focus of the intervention and quality of evidence available. The housing study is a noteworthy exception. While explicit in its aim to benefit people living in conditions of disadvantage, the study also makes the link between substandard housing and psychosocial wellbeing. This revelation was not an intended focus of the study, but rather a by-product of the strength of the instrument used to measure change.

Discussion

The purpose of this project was to identify interventions that showed strong evidence of positive impacts on population mental health in general, and on health equity in particular. We share some observations as to why so few mental health promotion interventions met the criteria for inclusion and propose ways to rectify these evidence gaps.

The first observation is that several interventions did not explicitly target health inequity in either their implementation activities, the measurement of their impacts, or both. These interventions could not be considered equity-focused even though a number of them showed potential benefits to vulnerable populations. There is a need for interventions to make health equity explicit from the outset.

For example, one promising intervention targeted potential high-school dropouts to evaluate the efficacy of a suicide prevention approach known as CAST (Coping and Support Training). The study reported positive outcomes for vulnerable adolescents who received the intervention (compared with usual-care), and included strategies to reduce disproportionate exposure to health-damaging factors – such as suicide ideation and drug involvement. However, it did not qualify as equity-focussed.[20]

The reasons for this are several. While explicitly aimed at vulnerable youth – using 'potential high school dropout' as a marker for suicide risk – the study did not directly address underlying conditions of dis/advantage. While data such as age, sex, and racial identity were collected (for the purpose of random sampling), the study could have explored the possible interactions and contextual factors related to risk of high school dropout or suicide. The study presented sex-associated differences in intervention outcomes as part of reporting on the results. However, these subanalyses were not part of an intentional equity analysis objective.[21]

From a suicide prevention perspective, the CAST protocol showed good promise among high-school age youth. From an equity perspective, the study may have also impacted the life chances of vulnerable youth by increasing the probability of high school graduation. However, the intervention could have more explicitly recognized high-school dropout as a 'condition of disadvantage,' given the option

TABLE 1
Examples of mental health promotion interventions that met the health equity criteria

Intervention name	Type	Country	Health equity content		
			Targeted population	Health equity goal(s)/ strategy(ies)	Key outcomes across major studies
Fast Track[15]	Promising Practice	United States	Children of families living in disadvantaged social-ecological contexts; students in high-risk schools	Classroom curriculum to develop children's emotional concepts, social understanding, and self-control; parent training groups to develop positive family-school relationships and behavior management skills; home visits for fostering parents' problem-solving skills, self-efficacy, and life management; child social skill training groups; child tutoring; child friendship enhancement in the classroom.	Improvements in parenting behavior, child social-cognitive skills, peer relationships, academic skills, and classroom social ecology; reduction in aggressive and delinquent behavior, juvenile and adult arrests, substance use problems and risky sexual behaviours.
Nurse Family Partnership[16]	Best Practices	Canada	First-time, low-income, mothers (at time of pregnancy to two years post-partum)	Home visits to support women to: link with needed health and human services, make good decisions about personal development, make healthy choices during pregnancy, provide competent care to improve the health and development of their children, build supportive relationships with families and friends, and become economically self-sufficient.	Improved maternal sense of mastery and self-sufficiency, fewer incidences of childhood injuries and maltreatment, fewer subsequent pregnancies and increased intervals between children, improved prenatal health, less frequent smoking, improved academic indicators for child, and decreased use of alcohol and drugs among children at follow-up.
Infant Health and Development Program[17]	Best Practices	United States	Low-income, socially isolated women and adolescents with low-birth weight, premature infants	Reduce the developmental and health problems of infants by providing medical, developmental and social assessments, referrals for health and social services, home visits, enrollment in a child development center, and parent group meetings.	Positive impacts on infant's cognitive, motor and behavioural skills and resilience, particularly for those infants born to the most at-risk families and who were at the "heavier" side of the low birth weight range. Positive impacts on mothers' employment, maternal stress, and reported symptoms of depression.
Family Spirit[18]	Ways Tried and True	United States	American Indian teenage mothers and their children	Provision of culturally tailored, strengths-based home visitation curricula to enhance parenting competence, reduce maternal psychosocial and behavioral risks, and promote healthy infant and toddler emotional and social adjustment.	Improvements in parenting knowledge, locus of control, depression symptoms, and externalizing behaviours; reduction in child externalizing, internalizing and dysregulation behaviours.
Housing, Insulation and Health Study[19]	Promising Practice	New Zealand	Occupants of uninsulated dwellings in low income communities	Installing insulation in existing homes.	Improvements in self-rated health, reduced symptoms of asthma and self-reported wheezing, fewer days off school and work, and fewer visits to general practitioners.

to explore the (indirect) benefits of high-school retention was available.

This evaluation study may serve as a case example to demonstrate the difference that incorporating equity as an explicit consideration can make; not only to the field of implementation science, but also to the efficacy of mental health interventions.

The second observation is that while many interventions did include a specific focus on health equity, the methods used to evaluate their impacts failed to meet accepted standards of rigour and replicability. For example, interventions received low "quality of evidence" scores when they did not report the actual size and demographic break-down of the sample participating in an intervention, or when a comparable 'control group' was left out. Low scores also resulted when interventions did not include objective or validated outcome measures or did not follow an adequate number of participants over time. Interventions must include descriptive baseline data and consider the use of comparable control groups (where possible) to improve the validity of their findings.

The tension between standards of evidence in the health sciences, and the evidence that can be gleaned from natural or social experiments, is not new.[22] Efforts to reconcile this discrepancy show a general tendency toward controlled interventions.[23] As a result, it was more difficult to include mental health interventions that were aimed at intervening at multiple levels or at influencing health outcomes indirectly (through changes in the built environment, for example). The further 'upstream' the intervention, the more difficult to control for a single variable or to define and follow a 'control group'. Human environments are fluid and multi-dimensional, making it more challenging, though not impossible, to meet a standard

of evidence that is regarded as rigorous in the health sciences.

This evidence impasse need not continue. Innovative examples of 'midstream' interventions have the potential to sustain health benefits for those who are more vulnerable.[14] Funding agencies and the recipients of funding are now experimenting with appropriate ways to capture evidence of impacts on equity so that we may learn from existing examples of innovation.

For example, contextual factors (such as leadership and readiness for change) are often integral to the effectiveness of population-level mental health interventions. The need for fidelity requires intervention researchers to adopt validated scales to monitor and measure change. However, a diversity of validated instruments is needed to study the impacts of interventions on complex phenomena such as mental health, so that the evidence produced is considered reliable and the associated interventions, largely replicable.

In 2016, PHAC published Toward Health Equity: A Practice Tool to more broadly encourage health equity in public health practice. This detailed diagram and companion document provides guidance on how to think about health equity, both in the design and implementation of population health interventions.[24]

Conclusion

The purpose of this review was to provide examples of well-designed and implemented population mental health interventions to improve health equity. Although few examples were found, we propose that by adopting three evidence-based methods consistently, implementers of social experiments and other complex interventions can enhance the validity of their findings and, ultimately, their capacity to contribute to this important field.

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Conflicts of interest

The authors have no conflicts of interest to disclose.

Authors' contributions and statement

NJ devised the project in collaboration with the Propel Centre for Population Health Impact. AF provided input on intervention screening, data analysis and interpretation. AS wrote the first draft with input from all authors, and revised the manuscript after providing intellectual content and a critical review. All authors discussed the results.

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At-a-glance

How Healthy are Canadians? A brief update

*CCDI Steering Committee**

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Introduction

The purpose of this At-a-glance is to provide an update on a number of the key findings from the 2016 Report, "How Healthy are Canadians?"[1] using results from the most recent edition (2018) of the Canadian Chronic Disease Indicators (CCDI; Table 1). The 2016 Report examined trends for the four major chronic diseases (cardiovascular disease [CVD],[†] cancer, chronic respiratory disease [CRD][‡] and diabetes) and four associated cross-cutting risk factors (tobacco smoking, physical inactivity, unhealthy eating and harmful use of alcohol) that formed the basis of the World Health Organization (WHO) *Global Action Plan for the Prevention and Control of Noncommunicable Diseases (NCDs) 2013-2020*.[2] In addition, the 2016 Report included mood and/or anxiety disorders because of their major impact on the health of Canadians. Therefore, this update does not focus on all results from the 2018 CCDI in Table 1 but highlights specific aspects of interest, namely the mortality and morbidity experiences of Canadians living with these major chronic diseases, as well as the associated risk factors. The reported results are based on the following four data sources: Canadian Chronic Disease Surveillance System (CCDSS); Canadian Community Health Survey (CCHS); Canadian Health Measure Survey; and, Canadian Vital Statistics–Death Database.

Main findings

Mortality

While the mortality rate associated with the four major chronic diseases has decreased by a third over an 18-year period (from 663/100 000 in 1998 to 441/100 000 in 2015; age-standardized mortality rates), the most dramatic decline was observed for CVD (nearly 50%). Nonetheless, CVD is still the second leading cause of death in Canada (196/100 000; crude mortality rate) after cancer (215/100 000; crude mortality rate), representing 27% and 29% of all deaths in 2015, respectively. Furthermore, the probability of dying between the ages of 30 and 69 years (i.e., premature mortality) from one of the four major chronic diseases decreased by nearly a third over the same period (from 14.9% in 1998 to 10.2% in 2015). While this is a positive finding, more still needs to be done since deaths due to these diseases among Canadians of this age group are often preventable.

Morbidity

One in three Canadian adults (33.7%) lives with at least one of the following chronic diseases: CVD; cancer; CRD; diabetes; mood and/or anxiety disorders. Specifically, in 2015/16, an estimated 2.4 million Canadians had ischemic heart disease and about 800 000 were living with the effects of a stroke, both common forms of CVD. Approximately 2.2 million reported ever having been diagnosed with cancer. Furthermore, 2.1 million were living with chronic obstructive pulmonary disease (COPD); one of the most common types of CRD, and 3.1 million Canadians were living with diabetes. Finally, 3.9 million reported having been diagnosed with mood and/or anxiety disorders in 2016.[§] In contrast to most chronic diseases which increase with age, mood and/or anxiety disorders are particularly prevalent in the working-age population (20-64-year-olds).

The number of individuals living with these chronic diseases continues to increase due to the aging and growth of the Canadian population, and the fact that people are living longer with their disease due to advances in treatment and management (Figure 1). On the other hand, the rate of new cases every year for most diseases is decreasing slowly, except for diabetes where more variations in trends were observed.[**] Most chronic diseases affect males and females somewhat differently, with some definitively more common in males (such as ischemic heart disease) and some more common in females (such as mood and/or anxiety disorders). Overall, women tend to adopt better health behaviours than men except for physical activity where levels are equally low for all Canadians. On the other hand, women live longer with age being a major, non-modifiable chronic disease risk factor.

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† CVD includes ischemic heart disease, heart failure and stroke.

‡ CRD includes chronic obstructive pulmonary disease (COPD) and asthma.

§ This estimate differs from that in the Report "How Healthy are Canadians?" as the 2016 Report used CCDSS data (i.e., annual use of health services for mood and/or anxiety disorders) while the CCDI used CCHS data (i.e., self-reported, diagnosed mood and/or anxiety disorders).

** The incidence rate (new cases over a year) based on the CCDSS data may indicate a true change in population health status, but may also reflect changes in data collection methods, coding/classification systems, clinical practices, billing methods, etc.

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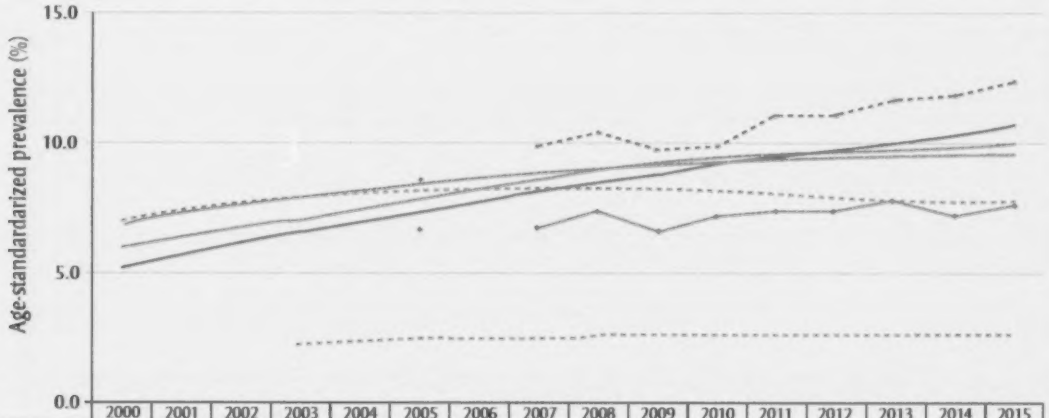
FIGURE 1
Age-standardized prevalence (%) in major chronic diseases among Canadians aged 20+, Canada, 2000–2015



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Cancer (ever had) (20+)						6.7		6.8	7.5	6.7	7.2	7.5	7.4	7.8	7.2	7.6
Asthma (20+)	5.2	5.7	6.2	6.6	7.0	7.4	7.8	8.2	8.5	8.8	9.2	9.5	9.8	10.1	10.4	10.8
Chronic obstructive pulmonary disease (35+)	7.0	7.4	7.7	8.0	8.2	8.4	8.6	8.8	9.0	9.2	9.3	9.4	9.5	9.5	9.6	9.6
Diabetes (20+)	6.0	6.4	6.8	7.1	7.5	7.9	8.3	8.6	8.9	9.2	9.4	9.6	9.7	9.8	9.9	10.1
Ischemic heart disease (20+)	7.1	7.5	7.8	8.0	8.1	8.2	8.3	8.3	8.3	8.3	8.2	8.1	8.0	7.9	7.9	7.8
Stroke (20+)				2.3	2.4	2.5	2.5	2.5	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
Mood and/or anxiety disorders (20+)						8.6		10.0	10.4	9.9	10.0	11.1	11.2	11.7	11.9	12.4

Sources: Canadian Community Health Survey - Annual Component, 2005 to 2015; Canadian Chronic Disease Surveillance System, 2000-01 to 2015-16.

Note: Cancer (ever had) and mood and/or anxiety disorders are based on self reported data and presented by calendar year; all other diseases and conditions are based on administrative data and are presented by fiscal year.

Behavioural risk factors

Similar to what the 2016 Report indicated, except for tobacco smoking, Canada continues to have high prevalence of modifiable risk factors associated with chronic diseases [physical inactivity (62.4% for children and youth and 82.5% for adults), unhealthy eating (70.0% for Canadians 12+ years) and harmful use of alcohol (15.2% of Canadians 15+ years)]. In 2016, 84.9% of Canadian adults reported having at least one of these behavioural risk factors.

Chronic diseases usually develop over many years or decades. Therefore, it is extremely important that Canadian children and youth adopt healthy behaviours from an early age. Unfortunately, only one in ten (9.5%) children aged 5 to 17 meet the recent 24-hour movement guidelines for children and youth for physical activity, sedentary behaviour and sleep.[3] Furthermore, only one in three children and youth (37.6%) meet the physical activity guidelines[11] suggesting more work needs to be done to increase activity in and commitment to sports and recreation, active transportation and physical activity at school.

Conclusion

Since the publication of the 2016 Report, overall and premature mortality trends have continued to decrease at a variable rate for the four major chronic diseases. However, the number of Canadians living with one or more of these chronic diseases continues to increase imposing a major burden on the health of Canadians and on the health care system. The chronic diseases included in this update represent the leading causes of death and disease burden in Canada and could be largely prevented by tackling a few common risk factors. Healthy living, prevention and adequate management of chronic diseases are all necessary to ensure that Canadians live a long, healthy and disease-free life.

Conflicts of interest

The authors have no conflicts of interest to disclose.

Authors' contributions and statement

LP chaired the Steering Committee and drafted the At-a-glance, BB managed the project and analyzed the data, PDR, PL, SO and GW analyzed and/or interpreted the data, and all co-authors reviewed and/or revised the At-a-glance.

The content and views expressed in this article are those of the authors and do not necessarily reflect those of the Government of Canada.

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[11] The new 2016 physical activity guidelines recommend that children and youth accumulate at least 60 minutes of moderate to vigorous physical activity (MVPA) per day on average per week (though not necessarily on each day), while the previous guidelines recommended 60 minutes of MVPA occur at least 6 days of the week. This modification to the guidelines resulted in a higher proportion of children and youth meeting the recommended level of physical activity (37.6% versus the previously reported 9.1%).

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TABLE 1

CANADIAN CHRONIC DISEASE INDICATORS

QUICK STATS, 2018 EDITION

INDICATOR GROUP	INDICATOR MEASURE(S)	LATEST DATA[a]	DATA SOURCE (YEAR)
SOCIAL AND ENVIRONMENTAL DETERMINANTS			
Education	% of population that reports having less than a high school education, population aged 20+ years	12.2%	CCHS (2016)
Income	% of population living below low-income cut-offs, after tax, total population	8.1%	CIS (2016)
Childhood poverty	% of children living below low-income cut-offs, after tax, population aged <18 years[b]	7.3%	CIS (2016)
Employment	Average annual unemployment rate (% of labour force that was unemployed during reference period), population aged 15+ years	6.3%	LFS (2017)
Community belonging	% of population that reports a "very strong" or "somewhat strong" sense of belonging to their local community, population aged 12+ years	68.8%	CCHS (2016)
MATERNAL AND CHILD HEALTH RISK AND PROTECTIVE FACTORS			
Diabetes during pregnancy	Rate of pregnant women with diagnosed diabetes (pre-existing and gestational diabetes)	90.5 per 1000 total births	DAD (2016)
Hypertension during pregnancy	Rate of pregnant women with diagnosed hypertension (pre-existing and gestational hypertension)	68.2 per 1000 total births	DAD (2016)
Maternal weight during pregnancy	% of women who report gestational weight gain above recommended Health Canada guidelines	42.8%[c]	CCHS (2016)
Preterm birth	% of live births with a gestational age at birth of less than 37 completed weeks	8.2 per 100 live births	DAD (2016)
Breastfeeding	% of women who report exclusive breastfeeding of their child for at least the first 6 months of life, women aged 15+ years	30.9%	CCHS (2016)
Exposure to second hand smoke	% of households with children aged <15 years that report regular child exposure to environmental tobacco smoke at home	2.8%	CTADS (2015)
Family violence	% of population that reports experiencing at least once before the age of 15 any type of physical or sexual assault and/or exposure to violence by an adult (18+ years),[d] population aged 15+ years	34.1%[e]	GSS (2014)
BEHAVIOURAL RISK AND PROTECTIVE FACTORS			
24-hour movement	% of children and youth who meet the Canadian 24-Hour Movement Guidelines for Children and Youth, population aged 5 to 17 years	9.5%	CHMS (2014 to 2015)
Physical activity	% of children and youth who meet physical activity recommendations by accumulating at least 60 minutes of moderate to vigorous physical activity per day (measured data), population aged 5 to 17 years	37.6%[f]	CHMS (2014 to 2015)
	% of adults who meet physical activity guidelines by accumulating at least 150 minutes of moderate to vigorous physical activity each week, in bouts of 10 minutes or more (measured data), population aged 18+ years	17.5%	CHMS (2014 to 2015)
Sedentary behaviour	% children and youth who report meeting sedentary behaviour recommendations by spending 2 hours or less per day watching television or using computers during leisure time, population aged 5 to 17 years	28.5%[g]	CHMS (2014 to 2015)
Sleep	% of population that reports obtaining the recommended amount of daily sleep, population aged 5+ years	65.5%	CHMS (2014 to 2015)
Nutrition	% of population that reports consuming fruit and vegetables at least 5 times/day, population aged 12+ years	30.0%	CCHS (2016)
	% of children and youth who report drinking sugar-sweetened beverages daily, population aged 5 to 17 years	16.0%	CHMS (2014 to 2015)
Chronic stress	% of population that reports life to be "quite a bit" or "extremely" stressful most days in the last 12 months, population aged 12+ years	21.5%	CCHS (2016)
Alcohol use	% of population that reports exceeding low risk alcohol drinking guidelines for chronic drinking, population aged 15+ years	15.2%	CTADS (2015)
Smoking	% of population that reports being current smokers (daily or occasional), population aged 15+ years	13.0%	CTADS (2015)
Drug use	% of population that reported using cannabis at least once a week in the last 3 months, population aged 15+ years	5.2%	CTADS (2015)
Main chronic disease risk factors prevalence	% of population that reports having at least one of four main chronic disease risk factors (tobacco smoking, physical inactivity, unhealthy eating and harmful use of alcohol), population aged 20+ years	84.9%	CCHS (2016)
RISK CONDITIONS			
Obesity	% of children and youth that are obese (measured data), population aged 5 to 17 years	13.1%	CHMS (2014 to 2015)
	% of adults that are obese (measured data), population aged 18+ years	26.1%	CHMS (2014 to 2015)
Elevated blood glucose	% of population with elevated[h] blood glucose (measured data), population aged 18+ years	4.1%	CHMS (2014 to 2015)
Elevated blood cholesterol	% of population with elevated[i] blood cholesterol [TC:HDL-C ratio] (measured data), population aged 18+ years	18.7%	CHMS (2014 to 2015)
Hypertension	% of population with diagnosed hypertension, population aged 20+ years	25.4%	CCDSS (2015–16)[j]

INDICATOR GROUP	INDICATOR MEASURE(S)	LATEST DATA[a]	DATA SOURCE (YEAR)
DISEASE PREVENTION PRACTICES			
Contact with health care professional	% of population that reports having a regular healthcare provider, population aged 12+ years	84.2%	CCHS (2016)
	% of population that reported consulting a dentist, dental hygienist or orthodontist at least once in the past 12 months, population aged 12+ years	69.3%	CCHS (2016)
Disease screening	% of women who report having had a mammogram at least once in the past 5 years, population aged 50 to 74 years	83.5%	CCHS (2012)
	% of women who report having had at least one Pap smear test in the past 3 years, population aged 25 to 69 years	79.7%	CCHS (2012)
	% of population that reports having had at least one fecal occult blood test, colonoscopy and/or sigmoidoscopy in the recommended time period, population aged 50 to 74 years	51.1%	CCHS (2012)
Vaccination (influenza)	% of population living with a chronic disease[b] that reported having a seasonal flu shot in the past 12 months, population aged 12+ years	47.0%	CCHS (2016)
HEALTH OUTCOMES/STATUS			
General health	% of population that reports their health is "very good" or "excellent," population aged 12+ years	60.9%	CCHS (2016)
	% of population that reports their mental health is "very good" or "excellent," population aged 12+ years	68.5%	CCHS (2016)
	Life expectancy at birth	83.3 years	CCDSS (2013–14 to 2015–16)
	Life expectancy at age 65	21.8 years	CCDSS (2013–14 to 2015–16)
	Health adjusted life expectancy at birth	71.9 years	CCDSS (2013–14 to 2015–16)
	Health-adjusted life expectancy at age 65	16.6 years	CCDSS (2013–14 to 2015–16)
Morbidity – prevalence	% of population with diagnosed diabetes, population aged 1+ years	8.6%	CCDSS (2015–16)
	% of population that reports having diagnosed cardiovascular diseases (heart disease or stroke), population aged 20+ years	6.2%	CCHS (2016)
	% of population with diagnosed ischemic heart disease, population aged 20+ years	8.5%	CCDSS (2015–16)
	% of population with diagnosed heart failure, population aged 40+ years	3.7%	CCDSS (2015–16)
	% of population with diagnosed stroke, population aged 20+ years	2.8%	CCDSS (2015–16)
	% of population with diagnosed asthma, population aged 1+ years	11.4%	CCDSS (2015–16)
	% of population with diagnosed chronic obstructive pulmonary disease, population aged 35+ years	10.2%	CCDSS (2015–16)
	% of population that reports ever being diagnosed with cancer, population aged 12+ years	7.2%	CCHS (2016)
	% of population that reports ever having symptoms consistent with at least 1 of 6 mental or substance use disorders,[c] population aged 15+ years	33.3%	CCHS-MH (2012)
	% of population that reports having diagnosed mood and/or anxiety disorders, population aged 12+ years	12.9%	CCHS (2016)
	% of population with diagnosed dementia, including Alzheimer's disease, population aged 65+ years	6.9%	CCDSS (2015–16)
	% of population with diagnosed osteoarthritis, population aged 20+ years	13.7%	CCDSS (2015–16)
	% of population with diagnosed osteoporosis, population aged 40+ years	11.9%	CCDSS (2015–16)
	% of population that reports having been diagnosed with at least 1 of the 5 major chronic diseases,[d] population aged 20+ years	41.7%	CCHS (2016)
	% of population that reports having been diagnosed with at least 1 of the 10 major chronic diseases,[e] population aged 20+ years (NEW)	44.2%	CCHS (2016)
Multimorbidity	% of population that reports having been diagnosed with at least 2 of the 5 major chronic diseases,[d] population aged 20+ years	8.9%	CCHS (2016)
	% of population that reports having been diagnosed with at least 2 of the 10 common chronic diseases,[e] population aged 20+ years	18.3%	CCHS (2016)

INDICATOR GROUP	INDICATOR MEASURE(S)	LATEST DATA[a]	DATA SOURCE (YEAR)
Morbidity—incidence	Rate of newly diagnosed diabetes cases, population aged 1+ years	595.4 per 100 000	CCDSS (2015–16)
	Rate of newly diagnosed ischemic heart disease cases, population aged 20+ years	591.8 per 100 000	CCDSS (2015–16)
	Rate of newly diagnosed acute myocardial infarction cases, population aged 20+ years	216.8 per 100 000	CCDSS (2015–16)
	Rate of newly diagnosed heart failure cases, population aged 40+ years	541.0 per 100 000	CCDSS (2015–16)
	Rate of newly diagnosed asthma cases, population aged 1+ years	464.8 per 100 000	CCDSS (2015–16)
	Rate of newly diagnosed chronic obstructive pulmonary disease cases, population aged 35+ years	818.2 per 100 000	CCDSS (2015–16)
	Rate of all newly diagnosed cancer cases, total population	561.6 per 100 000[f]	CCR/NCIRS (2017)
	Rate of newly diagnosed dementia cases, including Alzheimer's disease, population aged 65+ years	1372.6 per 100 000	CCDSS (2015–16)
	Rate of newly diagnosed osteoarthritis cases, population aged 20+ years	872.7 per 100 000	CCDSS (2015–16)
	Rate of newly diagnosed hip fracture, population aged 40+ years	146.6 per 100 000	CCDSS (2015–16)
Disability	% of population that reports being limited in their activities "sometimes" or "often" due to disease/illness, population aged 12+ years	12.7%	CCHS (2014)
Mortality	Death rate due to a major chronic disease (diabetes, cancer, cardiovascular diseases, chronic respiratory diseases), total population	478.0 per 100 000	CVSD (2015)
	Death rate due to diabetes, total population	20.0 per 100 000	CVSD (2015)
	Death rate due to cardiovascular diseases, total population	196.4 per 100 000	CVSD (2015)
	Death rate due to chronic respiratory diseases, total population	46.5 per 100 000	CVSD (2015)
	Death rate due to cancer, total population	215.0 per 100 000	CVSD (2015)
	Death rate due to suicide, total population	12.3 per 100 000	CVSD (2015)
	Death rate due to dementia, including Alzheimer's disease, total population	67.4 per 100 000	CVSD (2015)
	Death rate within one year of hip fracture, population aged 40+ years that had a hip fracture	227.5 per 1 000	CCDSS (2014–15)
Premature mortality	Probability of dying between ages 30 and 69 years from one of the major chronic diseases (cardiovascular diseases, cancer, chronic respiratory diseases, diabetes)	10.7%	CVSD (2015)
	Probability of dying between ages 30 and 69 years from cardiovascular disease	3.0%	CVSD (2015)
	Probability of dying between ages 30 and 69 years from cancer	6.1%	CVSD (2015)
	Probability of dying between ages 30 and 69 years from chronic respiratory disease	0.7%	CVSD (2015)
	Probability of dying between ages 30 and 69 years from diabetes	0.4%	CVSD (2015)

Abbreviations: CCDSS, Canadian Chronic Disease Surveillance System; CCHS, Canadian Community Health Survey; CCHS-MH, Canadian Community Health Survey – Mental Health; CCR, Canadian Cancer Registry; CHMS, Canadian Health Measures Survey; CIS, Canadian Income Survey; CTADS, Canadian Tobacco, Alcohol and Drugs Survey; CVSD, Canadian Vital Statistics–Death Database; DAD, Discharge Abstract Database; GSS, General Social Survey; HDL-C, high-density lipoprotein cholesterol; LFS, Labour Force Survey; NCIRS, National Cancer Incidence Reporting System; TC, total cholesterol.

Note: Indicators/measures identified as data gaps: Prenatal smoking, prenatal alcohol drinking, developmental disorders (including autism spectrum disorder [ASD] and fetal alcohol spectrum disorder [FASD]), social support, resilience, discrimination and stigma and built environment.

[a] All rates in this table are crude and based on actual data, unless otherwise stated.

[b] Includes all children aged 0–17 years both living in and not living in economic families.

[c] Total births include live births and stillbirths.

[d] This indicator has changed from previous editions; estimates are not directly comparable.

[e] Physical assault includes being slapped/hit/pushed/grabbed/shoved/thrown at/physically attacked at least once by an adult (18+ years); sexual assault includes forced/attempted forced sexual activity/touching at least once by an adult (18+ years); and exposure to violence includes having seen/heard parents or guardians hit each other or another adult (18+ years). The definition for this indicator changed; estimates are not directly comparable to previously reported estimates.

[f] This indicator captures individuals (excluding pregnant women) found to have elevated levels of the risk condition measured in a single fasting sample regardless of diagnosis status.

[g] CHMS data exist for this indicator to present pan Canadian rates of blood pressure status by diagnosis.

[h] Chronic diseases include: cancer (ever had), diabetes, cardiovascular diseases (heart disease and/or stroke), chronic respiratory diseases (asthma and/or chronic obstructive pulmonary disease).

[i] The six mental or substance use disorders include: major depressive episode, bipolar disorder, generalized anxiety disorder and abuse of/dependence on alcohol, cannabis or other drugs.

[j] The five main groups of chronic diseases include: cancer (ever had), diabetes, cardiovascular diseases (heart disease and stroke), chronic respiratory diseases (asthma and chronic obstructive pulmonary disease) and mood and/or anxiety disorders.

[k] The 10 chronic diseases included are heart disease, stroke, cancer (ever had), asthma, chronic obstructive pulmonary disease, diabetes, arthritis, Alzheimer's disease or other dementia, mood disorders and/or anxiety disorders.

[l] These numbers are projected estimates for 2017 that are based on the August 2015 CCR tabulation master file (1992–2013) and the NCIRS (1969–1991).

Suggested citation: Public Health Agency of Canada. Canadian Chronic Disease Indicators, Quick Stats, 2018 Edition. Ottawa (ON): Public Health Agency of Canada; 2018. #CCDI

For questions or comments, please contact us at: infobase@phac-aspc.gc.ca

Visit the Canadian Chronic Disease Indicators "online tool" to view additional data breakdowns (e.g. by sex, trends over time, etc.): http://infobase.phac-aspc.gc.ca.

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Release notice

The Canadian Paediatric Surveillance Program 2017 Results

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The Canadian Paediatric Society (CPS) and the Public Health Agency of Canada are pleased to announce the release of *The Canadian Paediatric Surveillance Program 2017 Results*.

The Canadian Paediatric Surveillance Program (CPSP) is a national child health surveillance program that monitors rare or emerging childhood diseases and conditions that are of public health importance.

This annual report summarizes the program's studies and one-time surveys carried out in 2017. Full studies examined: severe microcephaly, congenital Zika syndrome in infants, medically serious self-harm in youth requiring intensive care unit admission, acute flaccid paralysis (polio), adverse drug reactions, avoidant/restrictive food intake disorder, childhood Lyme disease, *Listeria* in the newborn and early infancy, non-type 1 diabetes, Pompe disease, complex regional pain syndrome and Rh sensitization.

One-time surveys conducted in 2017 covered: cannabis for medical purposes among Canadian children and youth, vaccine hesitancy and vaccine-preventable diseases, antiseptics causing chemical skin injuries/burns in newborns, and paediatric care of children from military families.

The report also contains an update on international developments in the surveillance, research and knowledge translation of rare paediatric diseases/conditions, as well as a list of recent presentations and publications on current and previous CPSP studies.

The CPSP provides an innovative means of identifying and obtaining data on rare diseases and conditions from over 2500 participants. The process for applying to launch a new study or survey is detailed at: https://www.cpsp.cps.ca/apply-proposez.

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Other PHAC publications

Researchers from the Public Health Agency of Canada also contribute to work published in other journals. Look for the following articles published in 2018:

Chernesky M, Jang D, Schweizer J, [...] **Severini A**, et al. HPV E6 oncoproteins and nucleic acids in neck lymph node fine needle aspirates and oral samples from patients with oropharyngeal squamous cell carcinoma. Papillomavirus Res. 2018;6:1-5. doi: 10.1016/j.pvr.2018.05.003.

Dai L, Chen Y, Sun W, **Liu S**. Association between hypertensive disorders during pregnancy and the subsequent risk of end-stage renal disease: a population-based follow-up study. J Obstet Gynaecol Can. 2018. doi: 10.1016/j.jogc.2018.01.022.

GBD 2016 Healthcare Access and Quality Collaborators (including **Badawi A** and **Lang JJ**). Measuring performance on the Healthcare Access and Quality Index for 195 countries and territories and selected subnational locations: a systematic analysis from the Global Burden of Disease Study 2016. Lancet. 2018;391(10136):2236-71. doi: 10.1016/S0140-6736(18)30994-2.

Rao DP, Abramovici H, **Crain J**, **Do MT**, **McFaull S**, **Thompson W**. The lows of getting high: sentinel surveillance of injuries associated with cannabis and other substance use. Can J Public Health. 2018;109(2):155-163. doi: 10.17269/s41997-018-0027-8.

Smith LK, Morisaki N, Morken NH, Gissler M, **Deb-Rinker P**, **Rouleau J**, et al. An international comparison of death classification at 22 to 25 weeks' gestational age. Pediatrics. 2018;142(1): e20173324. doi: 10.1542/peds.2017-3324.

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